

# इंटरनेट

# मानक

## Disclosure to Promote the Right To Information

Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

“जानने का अधिकार, जीने का अधिकार”

Mazdoor Kisan Shakti Sangathan

“The Right to Information, The Right to Live”

“पुराने को छोड़ नये के तरफ”

Jawaharlal Nehru

“Step Out From the Old to the New”

IS 11600 (1985): Index of Electrical Measuring Apparatus  
Used in Connection with Ionizing Radiation [LITD 8:  
Electronic Measuring Instruments, Systems and Accessories]



“ज्ञान से एक नये भारत का निर्माण”

Satyanarayan Gangaram Pitroda

“Invent a New India Using Knowledge”



“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”

Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”



BLANK PAGE



IS : 11600 - 1985  
IEC Pub 181 ( 1964 ) &  
IEC Pub 181 B ( 1966 )

*Indian Standard*

INDEX OF ELECTRICAL MEASURING  
APPARATUS USED IN CONNECTION WITH  
IONIZING RADIATION

UDC 621.317.7 : 621.387.132.24 ( 083.86 )

© Copyright 1988

**BUREAU OF INDIAN STANDARDS**  
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG  
NEW DELHI 110002

*Indian Standard*

**INDEX OF ELECTRICAL MEASURING  
APPARATUS USED IN CONNECTION WITH  
IONIZING RADIATION**

**National Foreword**

This Indian Standard which is identical with IEC Pub 181 ( 1964 ) 'Index of electrical measuring apparatus used in connection with ionizing radiation' and IEC Pub 181 B ( 1966 ) \* 'Supplement to Publication 181 ( 1964 )', issued by the International Electrotechnical Commission was adopted by the Indian Standards Institution on the recommendation of the Nuclear Instrumentation Sectional Committee and approved by the Electronics and Telecommunication Division Council.

In the adopted standard certain terminology and conventions are not identical with those used in Indian Standard; particularly, wherever the words 'International Standard' appear, referring to this standard, they should be read as 'Indian Standard'.

Only the English language text of the International Standard has been retained while adopting it in this Indian Standard. An Amendment to IEC Pub 181 ( 1964 ) [ Amendment No. 1 ( September 1964 ) ] has been incorporated in the adopted standard.

\* Pub 181 A ( 1965 ) 'Supplement to Pub 181 ( 1964 )' has not been adopted since it only gives the additional designations of the apparatus in foreign languages.

Adopted 28 October 1985

© July 1988, BIS

Gr 14

BUREAU OF INDIAN STANDARDS  
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG  
NEW DELHI 110002

As in the Original Standard, this Page is Intentionally Left Blank

**INDEX OF ELECTRICAL MEASURING  
APPARATUS USED IN CONNECTION WITH  
IONIZING RADIATION**

As in the Original Standard, this Page is Intentionally Left Blank



# CONTENTS

## CHAPTER I — GENERAL

	Page
1. Object ... ..	7
2. Choice of apparatus ... ..	7
3. General rules used in the terminology ... ..	7
4. Grouping ... ..	7
5. Numbering ... ..	8
6. Definition of general terms ... ..	8
SECTION 1-05 — APPARATUS - EQUIPMENT - ASSEMBLY - SUB-ASSEMBLY - BASIC FUNCTION UNIT ... ..	8
SECTION 1-10 — (RADIATION) MEASURING ASSEMBLY — (RADIATION) MONI- TOR — (RADIATION) INDICATOR ... ..	9

## CHAPTER II — BASIC RADIATION MEASURING APPARATUS

SECTION 2-05 — (RADIATION) MEASURING ASSEMBLIES ... ..	10
1. Mean current measuring assemblies ... ..	10
2. Pulse counting and/or counting rate assemblies ... ..	10
3. (Radiation) Analyzing assemblies ... ..	11
4. (Radiation) Multi-parameter analyzing assemblies ... ..	11
5. Other measuring assemblies ... ..	11
SECTION 2-10 — RADIATION DETECTORS ... ..	12
1. Ionization chambers ... ..	12
2. Track chambers ... ..	14
3. Special detectors ... ..	14
4. Scintillation detectors ... ..	14
5. Semiconductor detectors ... ..	14
6. Counter tubes ... ..	14
SECTION 2-15 — SUB-ASSEMBLIES ... ..	16
SECTION 2-20 — BASIC FUNCTION UNITS ... ..	16

## CHAPTER III — SPECIAL APPARATUS FOR THE CONTROL AND THE SAFETY OF NUCLEAR REACTORS

SECTION 3-05 — NUCLEAR MEASURING APPARATUS (OF NUCLEAR REACTOR) ... ..	18
1. Power measuring assemblies (of a nuclear reactor) ... ..	18
2. Sub-assemblies ... ..	18
3. Failed element detection and localization equipments (of a nuclear reactor) ... ..	18
SECTION 3-10 — WARNING OR SAFETY MECHANISMS AND ASSEMBLIES (OF A NUCLEAR REACTOR) ... ..	
1. Warning assemblies (of a nuclear reactor) ... ..	19
2. Safety assemblies (of a nuclear reactor) ... ..	19
3. Safety mechanisms (of a nuclear reactor) ... ..	19

	Page
SECTION 3-15 — SERVOMECHANISMS (OF A NUCLEAR REACTOR) ...	20
1. Control element drive mechanisms (of a nuclear reactor) ...	20
2. Position measuring assemblies (for a control element in a nuclear reactor) ...	20
3. Automatic control assemblies (for a nuclear reactor) ...	20
SECTION 3-20 — VARIOUS MEASURING ASSEMBLIES (FOR A NUCLEAR REACTOR) ...	20
CHAPTER IV — SPECIAL APPARATUS FOR HEALTH PHYSICS	
SECTION 4-05 — EXPOSURE OR ABSORBED DOSE, EXPOSURE OR ABSORBED DOSE RATE OR FLUX DENSITY METERS ...	22
SECTION 4-10 — CONTAMINATION OR ACTIVITY MEASURING ASSEMBLIES ...	22
1. Contamination of surfaces ...	22
2. Air contamination by aerosols ...	23
3. Contamination of water and other liquids ...	23
4. Gas (radio) activity ...	23
SECTION 4-15 — ASSEMBLIES FOR THE MEASUREMENT OF RADIOACTIVITY IN AN ORGANISM ...	23
1. Measuring assemblies for localized activity ...	23
2. Measuring assemblies for determination of whole-body gamma activity ...	23
CHAPTER V — SPECIAL APPARATUS FOR THE PROSPECTION AND FOR THE MINING INDUSTRY	
SECTION 5-05 — RADIOPROSPECTING ASSEMBLIES ...	25
SECTION 5-10 — EQUIPMENTS AND ASSEMBLIES FOR ORE CONTENT ESTIMATION AND GRADING AND FOR THE CONTROL OF PROCESSING PLANTS ...	26
1. Ore content meters ...	26
2. Ore grading and sorting equipments and assemblies ...	26
3. Chemical plant process control equipments and assemblies ...	26
CHAPTER VI — APPARATUS USING, FOR THE MEASUREMENT, AN IONIZING RADIATION SOURCE	
SECTION 6-05 — THICKNESS METERS (IONIZING RADIATION) — THICKNESS GAUGES (IONIZING RADIATION) ...	28
SECTION 6-10 — DENSITY METERS (IONIZING RADIATION) — DENSITY GAUGES (IONIZING RADIATION) ...	28
SECTION 6-15 — LEVEL METERS (IONIZING RADIATION) — LEVEL INDICATORS (IONIZING RADIATION) ...	29
SECTION 6-20 — CONTENT METERS (IONIZING RADIATION) — CONTENT MEASURING ASSEMBLIES (IONIZING RADIATION) ...	29
SECTION 6-25 — VARIOUS MEASURING ASSEMBLIES (IONIZING RADIATION) ...	30
ALPHABETICAL LIST ...	31
SUPPLEMENT TO PUBLICATION 181 (1964) ...	35

# INDEX OF ELECTRICAL MEASURING APPARATUS USED IN CONNECTION WITH IONIZING RADIATION

## CHAPTER I — GENERAL

### 1. Object

The object of this Recommendation is to facilitate consideration of a certain number of electrical measuring instruments used in connection with ionizing radiation\* by giving to each of them a designation and a definition permitting their unambiguous identification.

As an exception, in the field of control and safety of nuclear reactors, this Recommendation also defines certain apparatus which do not belong to the category of electrical measuring instruments in view of the necessity of considering nuclear reactor instrumentation as a whole.

### 2. Choice of apparatus

The present publication forms an index of measuring instruments currently manufactured by industry or likely to be so in the near future, but does not pretend to be complete in this respect. Additions will be made to this list later.

As a general rule, the instruments mentioned in the present Recommendation do not include the terminal apparatus which supplies the information unless it forms an integral part of the apparatus.

### 3. General rules used in the terminology

#### 3.1 Designation of apparatus

With the object of designating the apparatus in the clearest possible way, the name which is the most commonly used has been chosen wherever possible in the present Recommendation.

When this current name has been considered too imprecise, overlong or inadequate, new terms have been created.

In cases where, for various reasons, it has been necessary to indicate several names for the same instrument the name which should preferably be used has been placed first.

#### 3.2 Definitions of apparatus

The definitions have been drawn up with the view in mind of indicating for each apparatus, its most frequent use. Descriptive matter has been limited to that which seemed indispensable for the identification of the apparatus. In general, a correct balance between preciseness and simplicity has been sought as far as possible. In spite of the care taken, these definitions will evidently contain imperfections and later editions will endeavour to correct these.

NOTE — It has been necessary to lay down a certain number of definitions concerning:

- terms currently used in the nuclear field and which have not yet been defined elsewhere;
- terms currently used in other fields and for which a definition has been drawn up for the purpose of the present publication.

#### 3.3 Use of "meter" as suffix

By analogy with terms in general use and designating apparatus or categories of apparatus in fields other than nuclear ( density meter, spectrometer...) the following basic definition has been worked out to allow the creation of a certain number of shorter designations by using "meter" as suffix:

"\_\_\_\_\_ " **meter:**

A "\_\_\_\_\_ " meter is an apparatus intended to perform the measurement of a quantity connected with a phenomenon, the "\_\_\_\_\_ " denoting either the quantity or the phenomenon and including all necessary units for the performance of the measurement—and specially an indicating and/or recording instrument.

*Examples:* Content meter, Charge meter.

In some cases, in the present Recommendation, this term indicates improperly the apparatus without its associated radiation detector ( or detectors ) in order to take account of usage.

*Example:* Period meter.

### 4. Grouping

4.1 The present Recommendation does not claim to give a classification of apparatus. It will only be possible to do this at a later stage, after further consideration.

\*As defined by the I.C.R.U.: Any radiation consisting of directly or indirectly ionizing particles or a mixture of both.

**4.2** However, in order to facilitate the presentation, a classification of apparatus into 5 chapters has been made:

- Chapter II: Basic radiation measuring apparatus.
- Chapter III: Special apparatus for the control and the safety of nuclear reactors.
- Chapter IV: Special apparatus for health physics.
- Chapter V: Special apparatus for the prospection and for the mining industry.
- Chapter VI: Apparatus using, for the measurement, an ionizing radiation source.

In each chapter, the apparatus has been grouped in Sections similar to the system used in the International Electrotechnical Vocabulary.

Certain apparatus of very general use ( for example, detectors ), and thus likely to appear in several chapters has been mentioned only in Chapter II ( Basic radiation measuring apparatus ).

## **5. Numbering**

Each apparatus is identified by a six-figure group, comprising two groups of three figures:

- The first group is formed by the number of the Section to which the apparatus belongs.
- The second group represents the serial number of the apparatus in the Section.

The identification numbers have been chosen in steps of 5, so as to offer the possibility of insertion of new Sections or new apparatus in later editions.

## **6. Definition of general terms**

It has been found necessary to lay down a certain number of definitions concerning general terms which do not belong to a particular category of apparatus. These definitions are given in the two sections 1-05 and 1-10 which follow.

### **Section 1-05 — Apparatus - Equipment - Assembly - Sub-assembly - Basic function unit**

#### **105-005 Apparatus:**

A general term used in the present Recommendation for designating assemblies, sub-assemblies, basic function units, detectors, etc, in a title or text of general scope, when it is not practical to specify them more precisely. However, because of its lack of precision and varying interpretations, its use is deprecated in the definition of assemblies, sub-assemblies, basic function units, detectors, etc.

*Example :* Basic radiation measuring apparatus.

#### **105-010 Equipment:**

An association of assemblies associated to attain a determined final objective.

*Example :* Failed element detection and localization equipment.

#### **105-015 Assembly:**

A well-defined set of members necessary and sufficient to achieve a specified total function.

*Example :* A beta ( gamma ) pulse counting assembly may consist of a detector and a scaler.

#### **105-020 Sub-assembly:**

A removable part of an assembly which effects a partial function.

*Example :* In the beta ( gamma ) pulse counting assembly, the parts “detector”, “scale” are sub-assemblies.

#### **105-025 Basic function unit:**

A well-defined set of components which effects one ( or possibly more than one ) elementary function in an assembly or a sub-assembly, and which will appear as a physical unit when being removed.

*Example :* In the “scaler” sub-assembly, the “shaping unit”, “pulse amplitude discriminator unit”, “scaling unit”, “electromechanical register unit” are basic function units.

**NOTE —** Use of the term “device” without qualification has been avoided in the present Recommendation. This term, in current use, indicates an arrangement of components according to a given disposition or mounting and intended to produce a determined effect.

**Section 1-10 — ( Radiation ) Measuring assembly - ( Radiation ) Monitor -  
( Radiation ) Indicator**

**110-005 (Radiation) Measuring assembly:  
Radiation meter:**

An assembly including one or several radiation detectors and associated sub-assemblies or basic function units and designed to measure quantities connected with ionizing radiation (activity, exposure rate, etc).

*Example:* Mean current measuring assembly for alpha particles.

**110-010 (Radiation) Monitor:**

A radiation meter provided with means for giving perceptible warning (generally optical or acoustical) that the quantity connected with ionizing radiation exceeds some adjustable pre-determined value or that the measured value is not within some adjustable pre-determined limits.

*Example:* Alpha hand contamination monitor.

**110-015 (Radiation) Indicator:**

An assembly for quickly giving, by the variation of a perceptible signal (generally optical or acoustical), a coarse estimation of a quantity connected with ionizing radiation.

*Example:* Alpha contamination indicator.

**110-020 (Radiation) Warning assembly:**

A radiation monitor for which the only output is one or more warning signal(s).

*Example:* Beta-gamma door-way warning assembly.

## CHAPTER II — BASIC RADIATION MEASURING APPARATUS

This chapter contains the basic radiation measuring assemblies and detectors, sub-assemblies and basic function units which can be also used for the apparatus mentioned in the other chapters.

### Section 2-05 — ( Radiation ) Measuring Assemblies\*

- 1) Mean current measuring assemblies.
- 2) Pulse counting and/or counting rate assemblies.
- 3) (Radiation) Analyzing assemblies.
- 4) (Radiation) Multi-parameter analyzing assemblies.
- 5) Other measuring assemblies.

#### 1. MEAN CURRENT MEASURING ASSEMBLIES

##### 205-005 Mean current measuring assembly:

A measuring assembly which uses the current output of its radiation detector or detectors as the basis of operation.

##### 205-010 Mean current measuring assembly for alpha particles:

A measuring assembly designed to determine the activity of alpha emitters by measurement of a current.

##### 205-015 Mean current measuring assembly for beta particles (gamma rays):

A measuring assembly designed to determine the activity of beta (gamma) emitters by measurement of a current.

NOTE — Under particular conditions, some assemblies are capable of measuring the activity of beta and/or gamma emitters.

##### 205-020 Mean current measuring assembly for neutrons:

A measuring assembly designed to determine a neutron flux density by measurement of the output current of a neutron detector.

#### 2. PULSE COUNTING AND/OR COUNTING RATE ASSEMBLIES

##### 205-025 Pulse counting and/or counting rate assembly:

A measuring assembly designed to determine the number (pulse counting assembly) and/or counting rate (pulse counting ratemeter assembly) of the electrical output pulses of its radiation detector or detectors.

##### 205-030 Alpha pulse counting assembly:

A pulse counting assembly which includes an alpha radiation detector whose output pulses are applied to a counting sub-assembly (scaler) and/or to a counting rate measuring sub-assembly (ratemeter).

##### 205-035 Beta (gamma) pulse counting assembly:

A pulse counting assembly which includes a beta (gamma) radiation detector, whose output pulses are applied to a counting sub-assembly (scaler) and/or to a counting rate measuring sub-assembly (ratemeter).

##### 205-040 Gamma-gamma coincidence pulse counting assembly:

A coincidence counting assembly used, in particular, for the direct measurement of the activity of certain radio-nuclides. The assembly generally includes scintillation detectors.

##### 205-045 Low background pulse counting assembly:

A pulse counting assembly designed to measure very low activities and designed so as to reduce the background of the assembly by means of shielding, of anticoincidence arrays of detectors to eliminate the effects of cosmic rays, and/or by any other appropriate means.

\*Definition of (Radiation) measuring assembly: See number 110-005.

**205-050 Liquid scintillator pulse counting assembly:**

A low background pulse counting assembly designed to measure the activity of a solution of a low energy beta emitter (for example, radiocarbon or tritium), or of a solution of low specific activity, mixed with a liquid scintillator.

**205-055 Coincidence and anticoincidence pulse counting assembly:**

A pulse counting assembly possessing several coincidence and anticoincidence channels, the circuits of which may be connected to obtain various combinations of coincidence, with or without anticoincidence.

**205-060 Pulse counting ratemeter assembly:**

A pulse counting assembly which includes a detect whose output pulses are applied to a ratemeter usually linear or logarithmic.

**205-065  $2\pi$  ( $4\pi$ ) pulse counting assembly:**

A pulse counting assembly which includes a  $2\pi$  ( $4\pi$ ) radiation detector.

3. (RADIATION) ANALYZING ASSEMBLIES

**205-070 (Radiation) analyzing assembly:**

A measuring assembly designed to analyze the output signals from its radiation detector or detectors as a function of a given parameter (energy, time distribution, etc).

**205-075 Amplitude analyzing assembly:**

A measuring assembly designed to analyze the output signals from its detector or detectors as a function of the energy of the radiation.

**205-080 Amplitude analyzing assembly with storage function:**

An amplitude analyzing assembly which includes a multi-channel amplitude analyzer with storage function.

**205-085 Time-of-flight analyzing assembly:**

A measuring assembly designed to analyze the output signals from its radiation detector or detectors as a function of their time distribution.

**205-090 Gamma, (alpha), (beta) ray spectrometer:**

A measuring assembly for determining energy spectrum of gamma, (alpha), (beta) rays.

**205-095 Anti-Compton gamma-ray spectrometer:**

A gamma-ray spectrometer in which the effect of the Compton scattering is compensated.

4. (RADIATION) MULTI-PARAMETER ANALYZING ASSEMBLIES

**205-100 (Radiation) Multi-parameter analyzing assembly:**

A measuring assembly intended to record simultaneously the information delivered by its radiation detectors, and to analyze this information as a function of several parameters in order to establish correlations.

The analyzing assemblies are frequently associated with data processing instruments (digital converters, tape recorders, printers, computers, etc).

5. OTHER MEASURING ASSEMBLIES

**205-105 Activity meter with automatic changer:**

An activity meter including an automatic sample changer in front of its detector, the presentation and the measure being carried out according to a determined programme.

**205-110 (Radiation) Charge meter: Charge measuring integrator:**

An assembly designed to measure, by integrating the output current of radiation detector, the electrical charges collected, e.g. at the target of an accelerator.

**205-115 Leak detector:**

An assembly designed to detect, to locate and possibly to estimate, the leaks of an enclosure assumed to be tight.

**205-120 Hall effect magnetometer:**

Magnetometer using the measure of the potential difference produced by the Hall effect in a semiconductor crystal.

**205-125 Radiochromatograph:**

A measuring assembly designed to draw a representative curve of the activity of different organic components of a mixture, labelled with radio-nuclides and deposited, by a chromatograph method, on a paper strip moving in front of a radiation detector.

**205-130 Mass spectrograph:**

An assembly for analyzing a substance in terms of the ratios "mass to charge" of its components, and/or determining their relative abundances. The detection of the ions is obtained by photographic means.

**205-135 Mass spectrometer:**

An assembly for analyzing a substance in terms of the ratios "mass to charge" of its components, and/or determining their relative abundances. The detection of the ions is obtained by electrical means.

**205-140 Content meter by U. V. fluorescence:**

**U.V. excitation fluorimeter:**

A content meter usually used to determine the uranium content of a solution by measuring the fluorescent light intensity of uranyl salts excited by ultraviolet radiation.

**Section 2-10 — Radiation detectors**

The following list which contains the detectors that are widely used does not include physicochemical detectors nor those of the activation or chemical composition change type or calorimetric detectors.

- 1) **Ionization chambers.**
- 2) **Track chambers.**
- 3) **Special detectors.**
- 4) **Scintillation detectors.**
- 5) **Semiconductor detectors.**
- 6) **Counter tubes.**

**210-005 Radiation detector:**

An apparatus (in general a sub-assembly) or substance for the conversion of radiation energy into a form of energy which is suitable for indication and/or measurement.

**1. IONIZATION CHAMBERS**

**210-010 Ionization chamber:**

A radiation detector which employs an electric field for the collection at the electrodes, without gas multiplication, of charges associated with the ions produced in the sensitive volume by ionizing radiation\*.

According to the mode of utilization of the output signal, ionization chambers may be divided into three categories:

\*Ionization chambers are produced in metal, bakelite, polythene, celoron or other materials. These chambers may contain gas, air, or another gaseous mixture.

*a) Pulse ionization chamber:*

A type of ionization chamber designed to detect individually the pulses due to ionizing particles.

*b) Integration ionization chamber:*

An ionization chamber designed for the measurement of the accumulated charge caused by individual ionizing events occurring during some interval of time.

*c) Currenet ionization chamber:*

An ionization chamber used in such a manner that the average value of the ionization current in the chamber is measured.

**210-015 Free-air ionization chamber:**

An ionization chamber open to the air in which a delimited beam of radiation passes between the electrodes in such a way that neither the beam nor the secondary electrons produced within the beam strikes the electrodes. It is so designed that the volume of air which is taken as the basis for the calculation of the exposure is well defined. This type of chamber is mainly used as a standard ionization chamber.

**210-020 Boron chamber:**

An ionization chamber containing boron or boron compounds, which is used for detecting neutrons, mainly slow neutrons.



**210-025 Bragg-Gray cavity ionization chamber:**

An ionization chamber whose characteristics (sensitive volume, gas pressure, nature and thickness of the walls), are such that the conditions defining the Bragg-Gray cavity are met in practice. This type of chamber is used for determining the absorbed dose of X or gamma rays at the point of interest in a medium identical from the point of view of absorption with the wall material.

**210-030 Gas-flow ionization chamber:**

An ionization chamber in which an appropriate atmosphere is maintained by means of a slow flow of a suitable gas.

**210-035 Extrapolation ionization chamber:**

An ionization chamber in which one of the characteristics can be varied—most often the spacing between electrodes—in order to extrapolate its readings to zero chamber volume.

**210-040 Fission ionization chamber:**

An ionization chamber for detecting neutrons, containing fissile materials and in which the ionization is caused mainly by fission fragments produced by these neutrons.

**210-045 Grid ionization chamber:**

**Frisch ionization chamber:**

A pulse ionization chamber with flat electrodes, generally used to measure the energy of alpha particles or fission fragments. The chamber contains an additional electrode (Frisch grid), which is held at an intermediate potential and used to reduce the influence of heavy ions.

**210-050 Recoil proton (other recoil particles) ionization chamber:**

An ionization chamber in which ionization in the filling gas is produced by recoil particles resulting from the collision of fast neutrons with nuclei of light atoms.

**210-055 Air-wall ionization chamber:**

An air filled cavity ionization chamber whose walls consist of a substance such that the ionization produced inside the chamber is essentially the same as that which would be produced in air at the same point in the absence of the chamber.

**210-060 Liquid-wall ionization chamber:**

An ionization chamber designed to measure the alpha or beta activity of a liquid so situated that its surface constitutes the wall of the chamber.

**210-065 Well-type ionization chamber:**

An ionization chamber intended mainly for the measurement of activity of gamma emitting sources, having a central cylindrical well in which these sources are put. This type of chamber is used particularly for measuring sources having an appreciable volume.

**210-070 Ionization chamber with internal gas source:**

An ionization chamber in which the filling gas consists in all or in part of the radioactive gas whose activity is to be measured.

**210-075 Compensated ionization chamber:**

A differential ionization chamber designed in such a manner as to eliminate by compensation the effect of another radiation superimposed on that of the radiation which it is desired to measure.

**210-080 Capacitor ionization chamber:**

An ionization chamber in which the discharge caused by radiation induces a variation of the potential difference—which is the quantity measured—between the electrodes constituting a capacitor.

**210-085  $2\pi$  ( $4\pi$ ) ionization chamber:**

An ionization chamber with which the radiation emitted by a radioactive source may be detected within a solid angle of  $2\pi$  ( $4\pi$ ) steradians.

**210-090 Differential ionization chamber:**

An ionization chamber composed of two portions designed in such a manner that the output signal corresponds to the difference between the ionization currents of the two portions.

**210-095 Tissue-equivalent ionization chamber:**

A cavity ionization chamber designed for determining absorbed dose within the tissue of interest.

#### 210-100 Wall-less ionization chamber:

An ionization chamber in which the sensitive volume is not defined by walls, but by the lines of force of the electrical field determined by the form and arrangement of the electrodes, and the potential difference between electrodes.

#### 2. TRACK CHAMBERS

##### 210-105 Track chamber:

A radiation detector which makes the paths of ionizing particles visible.

##### 210-110 Bubble chamber:

A radiation detector for observing the paths of ionizing particles, based on the principle that in a superheated liquid bubbles are formed due to the boiling of the liquid along those paths.

##### 210-115 Cloud chamber:

A radiation detector for observing the paths of ionizing particles, based on the principle that the ions act in the oversaturated vapour as centres for condensation.

##### 210-120 Wilson cloud chamber:

###### Expansion cloud chamber:

A cloud chamber in which the supersaturation of the vapour is produced for a short time by a rapid expansion.

#### 3. SPECIAL DETECTORS

##### 210-125 Cerenkov detector:

A charged particle detector based on the Cerenkov effect.

##### 210-130 Spark detector:

###### Rosenblum detector:

A radiation detector in which the passage of a strongly ionizing particle produces, between electrodes, a spark accompanied by a voltage pulse of a measurable amplitude.

##### 210-135 Neutron thermopile:

A neutron detector in which the hot junctions of thermocouples are in thermal contact with a material which heats under the effect of neutron absorption.

#### 4. SCINTILLATION DETECTORS

##### 210-140 Scintillation detector:

A radiation detector using a medium in which a burst of luminescence radiation is produced along the path of an ionizing particle.

It consists of a scintillator, usually associated with a photomultiplier tube.

###### a) Scintillator:

A finite quantity of scintillating material intended to be element sensitive to radiation in a scintillation detecting device.

###### Scintillating material:

Any substance constituting an appropriate medium for the detection of radiation by means of the scintillation phenomenon.

###### b) Photomultiplier tube:

A vacuum tube (or valve) containing a photosensitive layer which serves as the cathode for an electron multiplier.

#### 5. SEMICONDUCTOR DETECTORS

##### 210-145 Semiconductor detector:

A radiation detector using either ionization or the creation of structural faults in a semiconductive medium.

#### 6. COUNTER TUBES

##### 210-150 Counter tube:

A radiation detector consisting of a gas-filled tube (or valve) whose gas amplification factor is much greater than one, and in which the individual ionizing events give rise to discrete electrical pulses\*.

Two operational modes are generally distinguished:

###### a) Proportional counter tube:

A counter tube operating in the proportional region.

###### Proportional region:

The range of operating voltage of a counter tube in which the gas amplification factor is independent of the

\*As pointed out with respect to ionization chambers, it should be noted that counter tubes have usually a glass or a metal envelope, the filling gas containing generally an organic vapour or a halogen.

primary ionization. The pulse amplitude is proportional to the total number of ions produced in the sensitive volume as a result of an ionizing event.

*b) Geiger-Müller counter tube:*

A counter tube operating in the Geiger-Müller region.

*Geiger-Müller region:*

The range of operating voltage of a counter tube in which each ionizing event gives rise to an output pulse having an amplitude independent of the number of ions initially produced in the sensitive volume by that ionizing event.

**210-155 Boron counter tube:**

A counter tube containing boron or boron compounds which is used for detecting neutrons, mainly slow neutrons.

**210-160 External cathode counter tube:  
Maze counter tube:**

A counter tube, the envelope of which is generally of glass, and the cathode of which is a carbon or metal coating on the external surface of this envelope.

**210-165 Gas-flow counter tube:**

A counter tube in which an appropriate atmosphere is maintained by means of a slow flow of suitable gas.

**210-170 Window counter tube:**

A counter tube in which a portion of the envelope is of such low absorption as to permit the detection of radiation of low penetrating power.

**210-175 Fission counter tube:**

A counter tube for detecting neutrons, containing fissile materials, and in which the initial ionization is caused mainly by fission fragments produced by these neutrons.

**210-180 Helium counter tube:**

A proportional counter tube containing helium and often employed for

measuring the energy of neutrons, using their reaction with helium 3.

**210-185 Dip counter tube:**

A counter tube specially designed to be dipped into the liquid whose activity is to be measured.

**210-190 Liquid counter tube:**

A counter tube intended to measure the activity of a liquid. Essentially the unit consists of a cylindrical counter tube surrounded by a coaxial cylindrical cup, which may be either fixed or removable. The liquid is introduced into the annular space between the cup and counter tube.

**210-195 Thin wall counter tube:**

A counter tube in which the envelope is of such low absorption as to permit the detection of radiation of low penetrating power.

**210-200 Recoil proton (other recoil particles) counter tube:**

A counter tube in which ionization in the gas filling is produced by recoil particles resulting from the collision of fast neutrons with nuclei of light atoms.

**210-205 Counter tube with internal gas source:**

A counter tube in which the filling gas consists in all or in part of the radioactive gas, whose activity is to be measured.

**210-210 End-window counter tube:**

A window counter tube with the window situated perpendicular to the axis of the tube.

**210-215 Bell counter tube:**

A type of end-window counter tube.

**210-220 Flat counter tube:**

A proportional counter tube formed by two metallized plane sheets between which several parallel wires are suspended, parallel to these sheets.

## Section 2-15 — Sub-assemblies\*

### 215-005 Amplitude analyzer:

A sub-assembly for determining the distribution function of a set of pulses in terms of their amplitude.

### 215-010 Multichannel amplitude analyzer with storage function:

An amplitude analyzer which includes a storage function to record the number of pulses received per channel.

### 215-015 Time-of-flight analyzer:

A sub-assembly designed to analyse the distribution in velocities of the particles in a beam according to the different times-of-flight over a given flight path.

### 215-020 Scaler:

A sub-assembly for counting electrical pulses and containing one or more scaling circuits.

### 215-025 Automatic scaler:

A scaler which includes an automatic stop-start circuit, which halts operation at the end of a preset count or time.

### 215-030 Electrometer:

A sub-assembly for the measurement of small electrical charges or currents.

### 215-035 Linear ratemeter:

An electronic sub-assembly which gives a continuous indication proportional to the average counting rate over a predetermined time interval.

### 215-040 Logarithmic ratemeter:

An electronic sub-assembly which gives a continuous indication proportional to the logarithm of the average counting rate over a predetermined time interval.

## Section 2-20 — Basic function units†

### 220-005 Linear pulse amplifier:

A pulse amplifier which, within the limits of its normal operating characteristics, delivers an output pulse of amplitude proportional to that of the input pulse.

### 220-010 Logarithmic pulse amplifier:

A pulse amplifier which, within the limits of its normal operating characteristics, delivers an output pulse of an amplitude proportional to the logarithm of the input pulse amplitude.

### 220-015 Linear direct current amplifier:

An amplifier whose output quantity is a linear function of the input quantity, even when the frequency of the input quantity approaches zero.

### 220-020 Logarithmic direct current amplifier:

An amplifier in which the output signal has a logarithmic relation to the input signal.

### 220-025 Stop-start unit:

A basic function unit designed for the automatic stopping and starting of counting, with pre-selection of a counting time or count number.

### 220-030 Time-base unit:

A basic function unit designed to provide pulses of a given shape in a rigorously periodic way.

### 220-035 Shaping unit:

A basic function unit designed to provide an output pulse of predetermined characteristics in response to an input pulse that is of a different shape.

### 220-040 Gating unit:

A basic function unit designed to either reject or accept a pulse as a function of a controlling signal.

### 220-045 Delay unit:

A basic function unit which delivers an output pulse after a given time interval in response to an input pulse.

\*Definition of sub-assembly, see number 105-020.

†Definition of basic function unit, see number 105-025.

**220-050 Linear delay unit:**

A basic function unit which, in response to an input pulse and after a given time interval, delivers a substantially identical output pulse.

**220-055 Scaling unit:**

A basic function unit containing a scaling circuit.

*Scaling circuit*

An electronic circuit which produces an output pulse each time a specified number of pulses has been received at its input.

**220-060 Pulse amplitude discriminator unit:**

A basic function unit containing a pulse amplitude discriminator.

*Pulse amplitude discriminator:*

A circuit which gives an output pulse for each input pulse whose amplitude lies above a given threshold value.

**220-065 (Electromechanical) Register unit:**

A basic function unit containing an (electromechanical) register.

*Electromechanical register:*

An electromechanical instrument counting electrical pulses.

**220-070 Pulse amplitude selector unit:**

A basic function unit containing a pulse amplitude selector.

*Pulse amplitude selector:*

A circuit which gives an output pulse for each input pulse whose amplitude lies within a chosen interval.

NOTE — In some countries, especially in France, this term is sometimes used to describe a pulse amplitude analyzer, although the pulse amplitude selector forms only a part of it.

**220-075 Single-channel pulse amplitude selector unit:**

A pulse amplitude selector unit in which the amplitude interval (channel) may be continuously shifted. The width of the channel is adjustable, but remains constant during the shifting.

**220-080 Coincidence selector unit:**

A basic function unit containing a coincidence selector.

A *coincidence selector* has a coincidence circuit and pulse shaping circuits which are placed between each radiation detector and the corresponding input of the coincidence circuit.

**220-085 Anticoincidence selector unit:**

A basic function unit containing an anticoincidence selector.

An *anticoincidence selector* has an anticoincidence circuit and pulse shaping circuits which are placed between each radiation detector and the corresponding input of the anticoincidence circuit.

**220-090 Stabilized power supply unit:**

An electrical power supply basic function unit, the output voltage (current) of which remains, as a function of time, within specified limits when operating under rated conditions.

## CHAPTER III — SPECIAL APPARATUS FOR THE CONTROL AND THE SAFETY OF NUCLEAR REACTORS

This chapter contains special electrical measuring apparatus for the control and the safety of nuclear reactors. In view of the necessity of considering the instrumentation of a nuclear reactor as a whole, this chapter contains also, as an exception, some non-electrical apparatus used for the same purposes.

### Section 3-05 — Nuclear measuring apparatus ( of a nuclear reactor )

- 1) **Power measuring assemblies (of a nuclear reactor).**
- 2) **Sub-assemblies.**
- 3) **Failed element detection and localization equipments (of a nuclear reactor).**

#### 1. POWER MEASURING ASSEMBLIES (OF A NUCLEAR REACTOR).

##### **305-005 Power measuring assembly based on the neutron flux density:**

A measuring assembly designed to determine the thermal power of a nuclear reactor by measuring the neutron flux density at a specified point or points.

##### **305-010 Power measuring assembly based on gamma radiation:**

A measuring assembly designed to determine the thermal power of a nuclear reactor by measuring the gamma flux density at a specified point or points.

##### **305-015 Power measuring assembly based on activation:**

A measuring assembly designed to determine the thermal power of a nuclear reactor by measuring the activation of an appropriate material.

#### 2. SUB-ASSEMBLIES\*

##### **305-020 Period meter (other designation under consideration):**

An electronic sub-assembly which, in association with one or more detectors, is used to indicate the time constant (period) of a nuclear reactor. Its indication may be given in units of time-constant, doubling time, decades per minute, etc.

##### **305-025 Reactivity meter**

An electronic sub-assembly which, in association with one or more detectors, gives an indication of the reactivity of a nuclear reactor.

##### **3. FAILED ELEMENT DETECTION AND LOCALIZATION EQUIPMENTS (OF A NUCLEAR REACTOR)**

##### **305-030 Failed element detection and localization equipment (of a nuclear reactor):**

An equipment for detection and localization of failed fuel elements and for following the progress of the failures.

It may include one or several failed element monitors and assemblies for failed element localization.

###### *a) Failed element monitor:*

An assembly designed for the detection of failures likely to occur in the clads which seal off the fuel from the coolant of a nuclear reactor.

###### *b) Assembly for failed element localization:*

An assembly designed for localization of failed elements by scanning the different channels of the nuclear reactor.

##### **305-035 Channel activity comparator:**

A measuring assembly which automatically compares the concentration of fission products in each fuel channel (or group of channels) with a preceding concentration measured in the same channel (or same group of channels), taken as reference.

##### **305-040 Electrostatic collector failed element monitor:**

A failed element monitor using the measurement of the activity of the fission gas daughters (such as rubidium and cesium) after collecting them on a negative electrode.

\*Definition of sub-assembly: see number 105-020.

**305-045 Cerenkov effect failed element monitor:**

A failed element monitor using the Cerenkov effect caused, in water, by the beta radiation of the fission radionuclides.

**305-050 Fission product separator failed element monitor:**

A failed element monitor using the separation of one or several fission products from the reactor coolant for their determination by measuring their activities.

**305-055 Delayed neutron failed element monitor:**

A failed element monitor based on detection of delayed neutrons emitted by certain fission products in the coolant.

**305-060 Failed element indicator:**

An indicator whose detector is situated in the main coolant circuit and which measures the concentration of fission products for fast indication of element failure.

**Section 3-10 — Warning or safety mechanism and assemblies ( of a nuclear reactor )**

**1) Warning assemblies (of a nuclear reactor).**

**2) Safety assemblies (of a nuclear reactor).**

**3) Safety mechanisms (of a nuclear reactor).**

**1. WARNING ASSEMBLIES (OF A NUCLEAR REACTOR)**

**310-005 Warning assembly (of a nuclear reactor):**

An assembly giving visual and possibly audible indication of the existence, even temporary, of abnormal conditions not likely to be of immediate serious consequence.

Such assemblies are generally composed of detectors and basic function units: amplifier, indicating and/or recording measuring instrument with optical and/or acoustical warning devices.

**2. SAFETY ASSEMBLIES (OF A NUCLEAR REACTOR)**

**310-010 Safety assembly (of a nuclear reactor):**

An assembly designed to receive information from various assemblies measuring the conditions of a nuclear reactor and able to initiate automatic action on one or several safety members in order to ensure integrity of the nuclear reactor.

**310-015 Programmed action safety assembly (of a nuclear reactor):**

A safety assembly which controls a decrease of power of a nuclear reactor according to a programme down to a value which is not necessarily zero.

**310-020 Normal shut-down safety assembly (of a nuclear reactor):**

A safety assembly which performs the nuclear reactor shut-down by means of a reversible mechanism enabling the insertion into the reactor, in due time and at the correct speed, of the necessary negative reactivity.

**310-025 Emergency shut-down safety assembly (of a nuclear reactor):**

A safety assembly which performs the rapid shut-down of a nuclear reactor by an action which is not necessarily reversible.

**3. SAFETY MECHANISMS (OF A NUCLEAR REACTOR)**

**310-030 Safety mechanism (of a nuclear reactor):**

A mechanism designed to initiate or accomplish the rapid decrease in reactivity, for example by movement of safety elements.

**310-035 Electromagnetic safety mechanism (of a nuclear reactor):**

A safety mechanism in which the safety member is actuated by an electromagnetic device (magnetic clutch, electromagnet, etc).

**310-040 Artificially accelerated safety mechanism (of a nuclear reactor)**

A safety mechanism in which an extra force is provided in order to activate the particular safety member into a nuclear reactor.

**Section 3-15 — Servomechanisms ( of a nuclear reactor )**

- 1) **Control element drive mechanisms (of a nuclear reactor).**
- 2) **Position measuring assemblies (for a control element in a nuclear reactor).**
- 3) **Automatic control assemblies (for a nuclear reactor).**

1. **CONTROL ELEMENT DRIVE MECHANISMS (OF A NUCLEAR REACTOR)**

**315-005 Control element drive mechanism (of a nuclear reactor):**

A mechanism designed to perform the shifting of the control elements of a nuclear reactor.

**315-010 Rotational control electromechanism (for a nuclear reactor):**

An electromechanism designed to perform a rotational motion of one or several nuclear reactor control elements.

**315-015 Linear control electromechanism (for a nuclear reactor):**

An electromechanism designed to perform a linear motion of one or several nuclear reactor control elements.

2. **POSITION MEASURING ASSEMBLIES (FOR A CONTROL ELEMENT IN A NUCLEAR REACTOR)**

**315-020 Position measuring assembly (for a control element in a nuclear reactor):**

A measuring assembly designed for the indication of the instantaneous position of control elements in a nuclear reactor.

**315-025 Potentiometric position measuring assembly (for a nuclear reactor):**

A position measuring assembly in which the signal is transmitted in the

form of an electrical potential difference which is a function of the position of the wiper of a potentiometer connected to the controlled element.

**315-030 Synchronous transmitter position measuring assembly (for a nuclear reactor):**

A position measuring assembly in which the signal is transmitted by the voltages induced in the stator (or rotor) windings of a synchronous transmitter, the rotor (or the stator) of which has an angular position related to the controlled element. The receiver is generally identical to the transmitter.

**315-035 Electromagnetic position measuring assembly (for a nuclear reactor):**

A position measuring assembly using the reluctance variation of a magnetic circuit, part of which is connected to the controlled element.

**315-040 Liquid moderator level meter (for a nuclear reactor):**

A level meter designed to measure the level of a liquid moderator in a nuclear reactor.

3. **AUTOMATIC CONTROL ASSEMBLIES (FOR A NUCLEAR REACTOR)**

**315-045 Automatic control assembly (for a nuclear reactor):**

An assembly designed to perform the automatic regulation of a quantity which is characteristic of the power of a reactor (such as the neutron flux density) and, in certain conditions, to change automatically the value of this quantity.

**Section 3-20 — Various measuring assemblies ( for a nuclear reactor )**
**320-005 Clad temperature computer (for a nuclear reactor):**

A computer that calculates the temperature reached by the hottest cladding inside a nuclear reactor. The calculation is based on the reactor

power and temperatures measured at certain points.

**320-010 Conductivity meter (for a nuclear reactor):**

An assembly for measuring the conductivity of a liquid, generally water,



associated with the operation of a nuclear reactor.

**320-015 Fluid flowmeter (for a nuclear reactor):**

An assembly for measuring the flow of a fluid in the cooling or moderating circuits of a nuclear reactor.

**320-020 Gas-flow neutron flux density measuring assembly (for a nuclear reactor):**

An assembly designed to measure the neutron flux density in a nuclear reactor and which consists of a target of fissile material and a detector, with a flow of inert gas from target to detector. The fission products created in the target by the neutron flux are carried by the flow to the detector, which is situated outside the reactor.

**320-025 Thermal power measuring assembly (for a nuclear reactor):**

An assembly including sub-assemblies for measuring the temperature and the flow-rates of the cooling fluid(s) associated to a computer, and designed to determine the thermal power of a nuclear reactor.

**320-030 Neutron flux density scanning assembly (for a nuclear reactor):**

An assembly designed to chart the neutron flux density of a nuclear reactor core by determining the distribution of the activity induced at different points of a suitable wire or tape previously exposed at known locations in the core.

**320-035 Liquid level meter (for a nuclear reactor):**

An assembly for measuring the level of a liquid associated with the operation of a nuclear reactor.

**320-040 Pressure meter (for a nuclear reactor):**

An assembly for measuring the pressure at a point in a nuclear reactor circuit.

**320-045 Heavy/light water heat exchanger leak monitor (for a nuclear reactor):**

A monitor designed to detect leakages between the primary heavy water coolant circuit and secondary light water coolant circuit of a nuclear reactor, by detecting radioactivity in the secondary circuit.

**320-050 pH-meter (for a nuclear reactor):**

An assembly for measuring the pH of a liquid associated with the operation of a nuclear reactor.

**320-055 Xenon poisoning predictor (for a nuclear reactor):**

Definition under consideration.

**320-060 Temperature meter (for a nuclear reactor):**

An assembly for measuring the temperature at a point in a nuclear reactor.

**320-065 Transfer function meter (for a nuclear reactor):**

An assembly for determining the transfer function of a nuclear reactor by measuring the variation of the neutron flux density caused by a modulation of the reactivity.

## CHAPTER IV — SPECIAL APPARATUS FOR HEALTH PHYSICS

This chapter contains special apparatus for health physics.

— Exposure or absorbed dose, exposure or absorbed dose rate or flux density meters.

— Contamination or activity measuring assemblies.

— Assemblies for the measurement of radioactivity in an organism.

### Section 4-05 — Exposure or absorbed dose, exposure or absorbed dose rate or flux density meters

#### 405-005 (G. M. counter tube) Exposure ratemeter:

A measuring assembly for the exposure rate, in which the detector is a built-in or separate Geiger-Müller counter tube.

#### 405-010 (Ionization chamber) Exposure ratemeter:

A measuring assembly for the exposure rate, in which the detector is a built-in or separate ionization chamber.

#### 405-015 (Scintillator) Exposure ratemeter:

A measuring assembly for exposure rate, in which the detector is a scintillator.

#### 405-020 (Scintillator) Fast neutron fluxmeter:

(Fast neutron detector: deprecated term):

An assembly designed to measure fast neutron flux density, in which the detector is a scintillator.

#### 405-025 (Counter tube) Fast neutron fluxmeter:

An assembly designed to measure fast neutron flux density, in which the

detector is a boron counter tube surrounded by a moderating material.

#### 405-030 (Recoil proton counter tube) Fast neutron fluxmeter:

An assembly designed to measure fast neutron flux density, in which the detector is a recoil proton counter tube.

#### 405-035 Slow neutron fluxmeter:

An assembly designed to measure slow neutron flux density, in which the detector is a boron counter tube.

#### 405-040 Capacitor dosimeter:

A dosimeter measuring the discharge of a capacitor under the effects of irradiation.

#### 405-045 Packet dosimeter (Fountain-pen type):

A term commonly used to denote a particular type of personal dosimeter.

NOTE — These dosimeters may be either direct reading or indirect reading.

*Personal dosimeter:*

Small dosimeter giving an evaluation of the exposure received by the carrier.

### Section 4-10 — Contamination or activity measuring assemblies

- 1) Contamination of surfaces.
- 2) Air contamination by aerosols.
- 3) Contamination of water and Other liquids.
- 4) Gas (radio) activity.

#### 1. CONTAMINATION OF SURFACES

#### 410-005 Alpha hand contamination monitor:

An assembly designed to measure the hand contamination by alpha emitters

and including a device for indicating contamination exceeding a predetermined value.

#### 410-010 Beta hand contamination monitor:

An assembly designed to measure the hand contamination by beta emitters and including a device for indicating contamination exceeding a predetermined value.

**410-015 Multiprobe radiation meter:**

A measuring assembly, usually employed for health physics purposes, provided with a set of probes which can be used for various measurements, an appropriate probe being chosen according to the quantity to be measured.

**410-020 Alpha contamination indicator:**

An indicator designed to detect alpha surface contamination, in which the output pulses from the detector control a warning signal.

**410-025 Beta (gamma) contamination indicator:**

An indicator designed to detect beta and gamma surface contamination, in which the output pulses from the detector control a warning signal.

**2. AIR CONTAMINATION BY AEROSOLS**

**410-030 8-hour (24-hour, etc) sampling monitor:**

An 8-hour sampler (24-hour sampler) equipped with an alarm, which is tripped if the activity of the trapped dust on the filter is higher than a pre-set value.

*8-hour (24-hour, etc) sampler:*

An apparatus designed to trap on a fixed filter the dust contained in known volume of air passing through the filter in 8 hours (24 hours, etc).

**410-035 Continuous air monitor:**

An air monitor in which the filter moves in front of built-in detectors to give a continuous measure of the contamination.

**410-040 Plutonium aerosol monitor:**

A monitor designed for the continuous measurement of atmospheric contamination due to plutonium aerosols (by taking into account parasitic alpha emitters).

**3. CONTAMINATION OF WATER AND OTHER LIQUIDS**

**410-045 Water (radio) activity meter:**

A (radio) activity meter designed for the continuous measurement of the activity of water by measuring the activity of the aerosol obtained by reducing the water to a fine spray.

**4. GAS (RADIO) ACTIVITY**

**410-050 Gas (radio) activity meter:**

A (radio) activity meter designed to measure the activity in a gas, and equipped with an indicating and/or recording measuring instrument.

**410-055 Radon content meter (for health physics purposes):**

An assembly used for health physics purposes to measure the content of radon and its daughters in the atmosphere.

**Section 4-15 — Assemblies for the measurement of radioactivity in an organism**

**1) Measuring assemblies for localized activity.**

**2) Measuring assemblies for determination of wholebody gamma activity.**

**415-005 Assembly for the measurement of radioactivity in an organism:**

An assembly designed to detect the presence of radionuclides in an organism and to measure their activity, possibly with identification of the nuclides concerned.

**1. MEASURING ASSEMBLIES FOR LOCALIZED ACTIVITY**

**415-010 Medical (radio) activity meter:**

An (radio) activity meter designed to localize, by means of appropriate

probes, the tissues having fixed radionuclides.

**415-015 (Body) Radiocartograph:**

An assembly designed to establish the radioactivity chart of a part of the human body, after absorption of a suitable radionuclide.

**2. MEASURING ASSEMBLIES FOR DETERMINATION OF WHOLE-BODY GAMMA ACTIVITY**

**415-020 Measuring assembly for determination of whole-body gamma activity:**

An assembly which measures the total gamma radiation (including

bremsstrahlung) emitted by the body and uses one or several scintillators heavily shielded against natural ambient radiation.

**415-025 Whole-body radiation meter:**

A measuring assembly for determination of the whole gamma activity of the human body.

**415-030 Whole-body radiation meter with amplitude analyzer:**

A measuring assembly including a whole-body radiation meter and an amplitude analyzer, designed to identify radionuclides present in the human body and to evaluate their respective activities.

## CHAPTER V — SPECIAL APPARATUS FOR THE PROSPECTION AND FOR THE MINING INDUSTRY

This chapter includes special apparatus for the radio-prospecting, mining and processing of radioactive ores, or ores capable of being graded by radiometric means.

### Section 5-05 — Radio-prospecting assemblies

#### 505-005 Radio-prospecting assembly:

An assembly designed for radiometric prospecting based on the detection of natural or artificially caused ionizing radiation.

#### 505-010 Prospecting audio-indicator:

A portable prospecting radiation indicator that contains its own power supply and provides an audible indication of photon flux density.

#### 505-015 Radon content meter (for prospecting purposes):

An assembly used in prospecting to measure the counting rate and/or the number of counts corresponding to the alpha particle emission rate from radon and its daughters in the air sample.

#### 505-020 Beryllium prospecting meter ( $\gamma$ , n):

A measuring assembly designed to be used in prospecting for beryllium ores: operation is usually based on the nuclear reaction ( $\gamma$ , n) of beryllium, the neutrons produced being counted after moderation.

#### 505-025 Radiometric bore-hole logging assembly:

##### Bore-hole radio-log:

An assembly designed to measure the radiation in a bore-hole as a function of the depth. It comprises a detector probe associated with a counting rate-meter and the necessary mechanical devices.

#### 505-030 ( G. M. counter tube ) Counting prospecting radiation meter:

A portable prospecting assembly containing its own power source, and designed for counting the photons detected by means of one or more Geiger-Müller counter tubes.

#### 505-035 ( G.M. counter tube ) Prospecting radiation meter:

A portable prospecting assembly containing its own power source, and designed to measure by means of one or several Geiger-Müller counter tubes, particle or photon flux density.

#### 505-040 ( Scintillator ) Prospecting radiation meter:

A portable prospecting assembly containing its own power supply, and designed to measure by means of a scintillator, particle or photon flux density.

#### 505-045 Vehicle-borne (scintillator) prospecting radiation meter:

A vehicle-borne (scintillator) prospecting radiation meter including in most cases a recorder the mechanism of which is driven by the movement of the vehicle.

#### 505-050 Vehicle-borne selective (scintillator) prospecting radiation meter:

A vehicle-borne (scintillator) prospecting radiation meter distinguishing between radiation due to thorium, uranium or other radioactive elements by means of selective measurement of photon flux density obtained through the use of amplitude discriminators.

#### 505-055 Vehicle-borne (scintillator) prospecting radiation meter with amplitude analyzer:

A vehicle-borne selective (scintillator) prospecting radiation meter using an amplitude analyzer, in which an identification line permits the determination of the nature of the radioactive element detected.

**Section 5-10 — Equipments and assemblies for ore content estimation and grading and for the control of processing plants**

- 1) Ore content meters.
- 2) Ore grading and sorting equipments and assemblies.
- 3) Chemical plant process control equipments and assemblies.

1. ORE CONTENT METERS

**510-005 Ore content meter:**

A measuring assembly designed to determine the metal content of ore by laboratory measurement on a given number of specimens of that ore.

**510-010 Uranium content meter (by beta and gamma radioactivity):**

A content meter designed to determine the uranium content of an ore sample by means of the measurement of beta and gamma activity of this sample.

**510-015 Beryllium content meter:**

A content meter designed to determine the beryllium content of an ore sample by means of the nuclear reaction ( $\gamma$ , n).

**510-020 Thorium content meter:**

A content meter designed to determine the thorium content of an ore sample by means of a method based on the difference between the half-lives of radon and thoron.

**510-025 Thorium content meter (by beta-alpha quasicoincidence):**

A content meter designed to determine the thorium content of a complex ore sample (at least 5% thorium) by means of a method based on quasicoincidence beta, alpha (thorium C and C').

2. ORE GRADING AND SORTING EQUIPMENTS AND ASSEMBLIES

**510-030 Ore grading and sorting equipment and assembly:**

An equipment or an assembly using natural or artificially caused radioactivity for the removal of sterile ore and the classification of ores in categories according to metal contents.

**510-035 Container load activity meter:**

An activity meter which includes detectors associated with an electronic sub-assembly and designed to measure and possibly to record the activity of a container load ( skip, truck, mine-car, etc ).

**510-040 Container sorting mine-head grading equipment**

An equipment which includes a container load activity meter associated with an automatic sorting device.

**510-045 Lot-sorting conveyor grading equipment:**

An equipment which includes one or several detectors, whose thresholds are determined according to the weight and are sited along the path of the mined products to control the grading of the lots in several categories of activity/weight. The equipment also records measured values.

**510-050 Lump-sorting grading equipment:**

An equipment which includes one or several activity measuring assemblies with adjustable threshold, and whose detectors are arranged along the path of the mined products to control ejectors for the sorting of previously calibrated lumps into several categories of activity.

3. CHEMICAL PLANT PROCESS CONTROL EQUIPMENTS AND ASSEMBLIES

NOTE 1 — Certain of the items below may be used at stations at a distance from the plant and generally as close as possible to the mine.

NOTE 2 — This paragraph includes also assemblies used in chemical plants other than those for the treatment of ore concentrates, such as plants for irradiated fuel reprocessing.

**510-055 Chemical plant process control equipment and assembly:**

An equipment or an assembly designed to determine the nature and the content of radionuclides in a mixture or in a solution and based on the selective measurement of the radiation emitted by the radionuclides present.

**510-060 Conveyor grading equipment:**

An equipment designed to grade ore or a mixture of ores transported on a conveyor, and also estimating the uranium content. Operation is based on the measurement of activity and weight.

**510-065 Pulp grading equipment:**

An equipment designed to grade the uranium content of a pulped ore and the weight of dry materials contained in this ore by measurement of activity flow-rate and density.

**510-070 (Ion-exchanger) Resin monitoring equipment:**

An equipment designed to determine the uranium contents in various solutions in connection with ionexchanger resin processing and which includes an alpha activity measuring assembly

associated with an automatic sample changer.

**510-075 Irradiated uranium reprocessing control assembly:**

An assembly designed for the continuous monitoring of fission product contents in uranium chemical reprocessing solutions. Detection is by means of a current ionization chamber, which measures exposures rate due to the gamma emission.

**510-080 Liquid film plutonium content meter:**

A content meter designed to determine the plutonium content of irradiated uranium reprocessing solutions by the measurement of specific alpha activity. The meter comprises a rotating drum partially immersed in the solution, and which, by its rotation, brings before the detector a thin liquid film which has been formed on its surface.

## CHAPTER VI — APPARATUS USING, FOR THE MEASUREMENT, AN IONIZING RADIATION SOURCE

This chapter concerns the assemblies which include an ionizing radiation source used for the measurement of a non-electrical quantity. As a consequence, radiation measuring assemblies which have an incorporated ionizing radiation source solely for calibration purposes do not fall into this category.

NOTE — The term "ionizing radiation" is used in the following designations of measuring assemblies and their definitions. It is thereby understood that each assembly possesses a particular  $\alpha$ , or  $\beta$ , or  $\gamma$ , or X, radiation or neutron source, and a corresponding detector.

### Section 6-05 — Thickness meters ( ionizing radiation ) — Thickness gauges ( ionizing radiation )

#### 605-005 Thickness meter ( ionizing radiation ):

A measuring assembly that includes an ionizing radiation source and is designed for non-destructive measurement of the thickness of a material by means of ionizing radiation.

#### 605-010 (Ionizing radiation) Transmission thickness meter:

A thickness meter including an ionizing radiation source and designed to determine material thickness by measurement of the radiation transmitted through this material.

#### 605-015 Beta ( gamma ) back-scatter thickness meter:

A thickness meter including a beta (gamma) radiation source and designed

to determine material thickness by measurement of the radiation back-scattered by this material. This assembly is frequently used for the measurement of lining or coating thicknesses.

#### 605-020 Portable gamma back-scatter thickness meter:

A portable thickness meter, which is a type of gamma back-scatter thickness gauge, and which is frequently used for the measurement of pipe wall thickness.

#### 605-025 X-fluorescence thickness meter:

A thickness meter including a source of ionizing radiation and designed to determine material thickness by measurement of X-fluorescence excited in the material itself or in the supporting material.

### Section 6-10 — Density meters ( ionizing radiation ) — Density gauges ( ionizing radiation )

#### 610-005 Density meter ( ionizing radiation ):

A measuring assembly that includes an ionizing radiation source and is designed to determine either the density of a material or the average specific gravity of a heterogeneous mixture, using the variation, within a defined geometry, of the absorption or diffusion of radiation.

#### 610-010 (Ionizing radiation) Transmission density meter:

Density meter measuring the radiation transmitted through the material. The

assembly is also used to check the homogeneity of a material.

#### 610-015 (Ionizing radiation) Back-scatter soil density meter:

A portable density meter designed to determine soil density by measurement of the radiation back-scattered by the soil.

#### 610-020 (Ionizing radiation) Transmission soil density meter:

A portable density meter designed to determine soil density by measurement of the radiation transmitted through the soil.



**Section 6-15 — Level meters ( ionizing radiation ) — Level indicators ( ionizing radiation )  
Level gauges ( ionizing radiation )**

**615-005 Level meter (ionizing radiation):**

A measuring assembly that includes an ionizing radiation source and is designed for the measurement or indication of the level in a container of liquid or granular substances, even when direct access to that level is not possible.

**615-010 "On-off" level indicator (ionizing radiation):**

An indicator including an ionizing radiation source and determining the absence or the presence, on the path between source and detector, of the material contained in an enclosure.

**615-015 Following level meter (ionizing radiation):**

A level meter including an "on-off" type level indicator associated with a servomechanism by means of which the source-detector set is compelled to follow the level.

**615-020 Static level meter (ionizing radiation):**

A level meter for continuous measurement of level and that includes a fixed ionizing radiation source and a detector disposed in such a way that the radiation imparted to the detector is a function of the level value.

**Section 6-20 — Content meters ( ionizing radiation ) — Content measuring assemblies ( ionizing radiation )**

**620-005 Content meter ( ionizing radiation):**

A measuring assembly that includes an ionizing radiation source and is designed to determine the content in one or several components of a gaseous, liquid, or solid substance, using the measurement of characteristics, within a defined geometry, of radiation resulting of the utilized process.

**620-010 Calcium and iron content into ore meter (ionizing radiation):**

A content meter designed to determine continuously calcium and iron content of ore samples by measurement of the characteristics X-radiation of these two elements.

**620-015 Coal ash content meter ( ionizing radiation ):**

A content meter designed to determine ash content in coal by measurement of the radiation back-scattered or transmitted by the coal.

**620-020 Sulphur content meter for hydrocarbons (ionizing radiation):**

A content meter designed to determine the sulphur content of hydrocarbons by

measurement of residual radiation after absorption in the hydrocarbon.

**620-025 Carbon hydrogen ratio measuring assembly for hydrocarbons (ionizing radiation):**

A measuring assembly including a beta radiation source and designed to determine carbon/hydrogen ratio in hydrocarbon samples of known densities, by measurement of the radiation transmitted through the sample.

**620-030 X-ray fluorescence content meter:**

**X-ray excitation fluorimeter:**

A content meter for the determination of the content of one or several elements in liquid or solid samples, by measurement of X-ray fluorescence excited by X-rays.

**620-035 Soil moisture meter ( ionizing radiation ):**

A content meter including a fast neutron source and designed to determine soil water contents through counting the neutrons moderated by the hydrogen nuclei in the water molecules.

**Section 6-25 — Various measuring assemblies ( ionizing radiation )**

**625-005 Ionized-gas anemometer:**

An assembly for the measurement of the velocity of gas and comprising an ionizing radiation source included in an ionization chamber through which the gas studied is flowing, the value of the velocity being determined from the current of the chamber.

**625-010 Vacuum meter with alpha emitter:**

A vacuum meter for the measurement

of low pressures and comprising an alpha radiation source included in an ionization chamber communicating with the enclosure, the vacuum of which is to be determined : the gas of the chamber is thus at the same pressure as the gas in the enclosure and the current of the chamber provides the measure of this pressure.

# ALPHABETICAL LIST

## A

Activity meter with automatic changer	...	205-105
Air-wall ionization chamber	...	210-055
Alpha contamination indicator	...	410-020
Alpha hand contamination monitor	...	410-005
Alpha pulse counting assembly	...	205-030
Amplitude analyzer	...	215-005
Amplitude analyzing assembly	...	205-075
Amplitude analyzing assembly with storage function	...	205-080
( Radiation ) analyzing assembly	...	205-070
Anticoincidence selector	...	220-085
Anticoincidence selector unit	...	220-085
Anti-Compton gamma-ray spectrometer	...	205-095
Apparatus	...	105-005
Artificially accelerated safety mechanism ( of a nuclear reactor )	...	310-040
Assembly	...	105-015
Assembly for failed element localization	...	305-030b)
Assembly for the measurement of radioactivity in an organism	...	415-005
Automatic control assembly ( for a nuclear reactor )	...	315-045
Automatic scaler	...	215-025

## B

( Ionizing radiation ) Back-scatter soil density meter	...	610-015
Basic function unit	...	105-025
Bell counter tube	...	210-215
Beryllium content meter	...	510-015
Beryllium prospecting meter ( $\gamma - n$ )	...	505-020
Beta ( gamma ) back-scatter thickness meter	...	605-015
Beta ( gamma ) contamination indicator	...	410-025
Beta hand contamination monitor	...	410-010
Beta ( gamma ) pulse counting assembly	...	205-035
Bore-hole radio-log	...	505-025
Boron chamber	...	210-020
Boron counter tube	...	210-155
Bragg-Gray cavity ionization chamber	...	210-025
Bubble chamber	...	210-110

## C

Calcium and iron content in ore meter ( ionizing radiation )	...	620-010
Capacitor dosimeter	...	405-040
Capacitor ionization chamber	...	210-080
Carbon/hydrogen ratio measuring assembly for hydrocarbons ( ionizing radiation )	...	620-025
Cerenkov detector	...	210-125
Cerenkov effect failed element monitor	...	305-045
Channel activity comparator	...	305-035
Charge measuring integrator	...	205-110
( Radiation ) Charge meter	...	205-110
Chemical plant process control assembly	...	510-055
Chemical plant process control equipment	...	510-055
Clad temperature computer ( for a nuclear reactor )	...	320-005
Cloud chamber	...	210-115
Coal ash content meter ( ionizing radiation )	...	620-015
Coincidence and anticoincidence pulse counting assembly	...	205-055
Coincidence selector	...	220-080
Coincidence selector unit	...	220-080
Compensated ionization chamber	...	210-075
Conductivity meter ( for a nuclear reactor )	...	320-010
Container load activity meter	...	510-035
Container sorting mine-head grading equipment	...	510-040
Content meter ( ionizing radiation )	...	620-005
Content meter by U. V. fluorescence	...	205-140
Continuous air monitor	...	410-035

Control element drive mechanism ( of a nuclear reactor )	...	315-005
Conveyor grading equipment	...	510-060
Counter tube	...	210-150
Counter tube with internal gas source	...	210-205
( G. M. counter tube ) Counting prospecting radiation meter	...	505-030
Current ionization chamber	...	210-010c)

## D

Delayed neutron failed element monitor	...	305-055
Delay unit	...	220-045
Density meter ( ionizing radiation )	...	610-005
Differential ionization chamber	...	210-090
Dip counter tube	...	210-185

## E

8-hour ( 24-hour, etc ) sampler	...	410-030
8-hour ( 24-hour, etc ) sampling monitor	...	410-030
Electromagnetic position measuring assembly ( for a nuclear reactor )	...	315-035
Electromagnetic safety mechanism ( of a nuclear reactor )	...	310-035
Electromechanical register	...	220-065
Electrometer	...	215-030
Electrostatic collector failed element monitor	...	305-040
Emergency shut-down safety assembly ( of a nuclear reactor )	...	310-025
End-window counter tube	...	210-210
Equipment	...	105-010
Expansion cloud chamber	...	210-120
( G. M. counter tube ) Exposure ratemeter	...	405-005
( Ionization chamber ) Exposure ratemeter	...	405-010
( Scintillator ) Exposure ratemeter	...	405-015
External cathode counter tube	...	210-160
Extrapolation ionization chamber	...	210-035

## F

Failed element detection and localization equipment ( of a nuclear reactor )	...	305-030
Failed element indicator	...	305-060
Failed element monitor	...	305-030a)
( Counter tube ) Fast neutron fluxmeter	...	405-025
( Recoil proton counter tube ) Fast neutron fluxmeter	...	405-030
( Scintillator ) Fast neutron fluxmeter	...	405-020
Fission counter tube	...	210-175
Fission ionization chamber	...	210-040
Fission product separator failed element monitor	...	305-050
Flat counter tube	...	210-220
Fluid flowmeter ( for a nuclear reactor )	...	320-015
Following level meter ( ionizing radiation )	...	615-015
Free air ionization chamber	...	210-015
Frisch ionization chamber	...	210-045

## G

Gamma-gamma coincidence pulse counting assembly	...	205-040
Gamma ( alpha ) ( beta ) ray spectrometer	...	205-090
Gas ( radio ) activity meter	...	410-050
Gas-flow counter tube	...	210-165
Gas flow ionization chamber	...	210-030
Gas-flow neutron flux density measuring assembly ( for a nuclear reactor )	...	320-020
Gating unit	...	220-040
Geiger-Müller counter tube	...	210-150b)
Geiger-Müller region...	...	210-150b)
Grid ionization chamber	...	210-045

**H**

Hall effect magnetometer	...	205-120
Heavy/light water heat exchanger leak monitor ( for a nuclear reactor )	...	320-045
Helium counter tube	...	210-180

**I**

( Radiation ) Indicator	...	110-015
Integration ionization chamber	...	210-010b)
Ionization chamber	...	210-010
Ionization chamber with internal gas source	...	210-070
Ionized-gas anemometer	...	625-005
Irradiated uranium reprocessing control assembly	...	510-075

**L**

Leak detector	...	205-115
Level meter ( ionizing radiation )	...	615-005
Linear control electromechanism ( for a nuclear reactor )	...	315-015
Linear delay unit	...	220-050
Linear direct current amplifier	...	220-015
Linear pulse amplifier	...	220-005
Linear ratemeter	...	215-035
Liquid counter tube	...	210-190
Liquid film plutonium content meter	...	510-080
Liquid level meter ( for a nuclear reactor )	...	320-035
Liquid moderator level meter ( for a nuclear reactor )	...	315-040
Liquid scintillator pulse counting assembly	...	205-050
Liquid-wall ionization chamber	...	210-060
Logarithmic direct current amplifier	...	220-020
Logarithmic pulse amplifier	...	220-010
Logarithmic ratemeter	...	215-040
Lot-sorting conveyor grading equipment	...	510-045
Low background pulse counting assembly	...	205-045
Lump-sorting grading equipment	...	510-050

**M**

Mass spectrograph	...	205-130
Mass spectrometer	...	205-135
Maze counter tube	...	210-160
Mean current measuring assembly	...	205-005
Mean current measuring assembly for alpha particles	...	205-010
Mean current measuring assembly for beta particles ( gamma rays )	...	205-015
Mean current measuring assembly for neutrons	...	205-020
( Radiation ) Measuring assembly	...	110-005
Measuring assembly for determination of wholebody gamma activity	...	415-020
Medical ( radio ) activity meter	...	415-010
( Radiation ) Monitor	...	110-010
Multichannel amplitude analyser with storage function	...	215-010
( Radiation ) Multi-parameter analysing assembly	...	205-100
Multiprobe radiation meter	...	410-015

**N**

Neutron flux density scanning assembly ( for a nuclear reactor )	...	320-030
Neutron thermopile	...	210-135
Normal shut-down safety assembly ( of a nuclear reactor )	...	310-020

**O**

On-off level indicator ( ionizing radiation )	...	615-010
Ore content meter	...	510-005
Ore grading and sorting assembly	...	510-030
Ore grading and sorting equipment	...	510-030

**P**

Period meter	...	305-020
Personal dosimeter	...	405-045
pH-meter ( for a nuclear reactor )	...	320-050
Photomultiplier tube	...	210-140b)
Plutonium aerosol monitor	...	410-040
Pocket dosimeter ( fountain-pen type )	...	405-045
Portable gamma back-scatter thickness meter	...	605-020
Position measuring assembly ( for a control element in a nuclear reactor )	...	315-020
Potentiometric position measuring assembly ( for a nuclear reactor )	...	315-025
Power measuring assembly based on activation	...	305-015
Power measuring assembly based on gamma radiation	...	305-010
Power measuring assembly based on the neutron flux density	...	305-005
Pressure meter ( for a nuclear reactor )	...	320-040
Programmed action safety assembly ( of a nuclear reactor )	...	310-015
Proportional counter tube	...	210-150a)
Proportional region	...	210-150a)
Prospecting audio-indicator	...	505-010
( G. M. counter tube ) Prospecting radiation meter	...	505-035
( Scintillator ) Prospecting radiation meter	...	505-040
Pulp grading equipment	...	210-065
Pulse amplitude discriminator	...	220-060
Pulse amplitude discriminator unit	...	220-060
Pulse amplitude selector	...	220-070
Pulse amplitude selector unit	...	220-070
Pulse counting and/or counting rate assembly	...	205-025
Pulse counting ratemeter assembly	...	205-060
Pulse ionization chamber	...	210-010a)

**R**

Radiation detector	...	210-005
( Body ) Radiocartograph	...	415-015
Radiochromatograph	...	205-125
Radiometric bore-hole logging assembly	...	505-025
Radiometric prospecting assembly	...	505-005
Radon content meter ( for health physics purposes )	...	410-055
Radon content meter ( for prospecting purposes )	...	505-015
Ratemeter ( Linear- )	...	215-035
Reactivity meter	...	305-025
Recoil proton ( other recoil particles ) counter tube	...	210-200
Recoil proton ( other recoil particles ) ionization chamber	...	210-050
( Electromechanical ) Register unit	...	220-065
( Ion-exchanger ) Resin monitoring equipment	...	510-070
Rosenblum detector	...	210-130
Rotational control electromechanism ( for a nuclear reactor )	...	315-010

**S**

Safety assembly ( of a nuclear reactor )	...	310-010
Safety mechanism ( of a nuclear reactor )	...	310-030
Scaler	...	215-020
Scaling circuit	...	220-055
Scaling unit	...	220-055
Scintillating material	...	210-140a)
Scintillation detector	...	210-140
Scintillator	...	210-140a)
Semiconductor detector	...	210-145
Shaping unit	...	220-035
Single-channel pulse amplitude selector unit	...	220-075
Slow neutron fluxmeter	...	405-035
Soil moisture meter ( ionizing radiation )	...	620-035
Spark detector	...	210-130
Stabilized power supply unit	...	220-090
Static level meter ( ionizing radiation )	...	615-020
Stop-start unit	...	220-025

Sub-assembly ... ..	105-020
Sulphur content meter for hydrocarbons ( ionizing radiation )	620-020
Synchronous transmitter position measuring assembly ( for a nuclear reactor )	315-030

## T

Temperature meter (for a nuclear reactor)	320-060
Thermal power measuring assembly ( for a nuclear reactor )	320-025
Thickness meter ( ionizing radiation )	605-005
Thin wall counter tube	210-195
Thorium content meter	510-020
Thorium content meter ( by beta-alpha quasi coincidence )	510-025
Time-base unit	220-030
Time-of-flight analyzer	215-015
Time-of-flight analyzing assembly	205-085
Tissue-equivalent ionization chamber	210-095
Track chamber	210-105
Transfer function meter ( for a nuclear reactor )	320-065
( Ionizing radiation ) Transmission density meter	610-010
( Ionizing radiation ) Transmission soil den- sity meter	610-020
( Ionizing radiation ) Transmission thickness meter	605-010
2 $\pi$ ( 4 $\pi$ ) ionization chamber	210-085
2 $\pi$ ( 4 $\pi$ ) pulse counting assembly	205-065

## U

Uranium content meter (by beta and gamma radioactivity )	510-010
U. V. excitation fluorimeter	205-140

## V

Vacuum meter with alpha emitter	625-010
Vehicle-borne ( scintillator ) prospecting radiation meter	505-045
Vehicle-borne ( scintillator ) prospecting radiation meter with amplitude analyzer	505-055
Vehicle-borne selective ( scintillator ) pros- pecting radiation meter	505-050

## W

Wall-less ionization chamber	210-100
Warning assembly (of a nuclear reactor)	310-005
Water ( radio ) activity meter	410-045
Well-type ionization chamber	210-065
Whole-body radiation meter	415-025
Whole-body radiation meter, with amplitude analyzer	415-030
Wilson cloud chamber	210-120
Window counter tube	210-170

## X

Xenon poisoning predicator ( for a nuclear reactor )	320-055
X-fluorescence thickness meter	605-025
X-ray excitation fluorimeter	620-030
X-ray fluorescence contentmeter	620-030

As in the Original Standard, this Page is Intentionally Left Blank

**SUPPLEMENT TO PUBLICATION 181 ( 1964 )**

As in the Original Standard, this Page is Intentionally Left Blank



# CONTENTS

	Page
GENERAL	
1. Object ...	38
2. Choice of apparatus	38
3. Principles and general rules	38
4. Definition of apparatus	38
5. Numbering	38

## CHAPTER I — GENERAL TERMS

Section 1-05	39
Section 1-10	39
Section 1-15	39
Section 1-20	39

## CHAPTER II — BASIC RADIATION MEASURING APPARATUS

Section 2-05 — (Radiation) measuring assemblies	40
Section 2-10 — Radiation detectors	40
Section 2-15 — Sub-assemblies	40
Section 2-20 — Basic function units	41

## CHAPTER III — SPECIAL APPARATUS FOR THE CONTROL AND THE SAFETY OF NUCLEAR REACTORS

Section 3-05 — Nuclear measuring apparatus (of a nuclear reactor)	42
Section 3-10 — Warning or safety mechanisms and assemblies (of a nuclear reactor)	42
Section 3-20 — Various measuring assemblies (for a nuclear reactor)	42

## CHAPTER IV — SPECIAL APPARATUS FOR HEALTH PHYSICS

Section 4-05 — Exposure or absorbed dose, exposure or absorbed dose rate or flux density meters	43
Section 4-10 — Contamination or activity measuring assemblies	43
Section 4-20 — Criticality protection assemblies	44

## CHAPTER VI — APPARATUS USING, FOR THE MEASUREMENT, AN IONIZING RADIATION SOURCE

Section 6-25 — Various measuring assemblies (ionizing radiation)	45
ALPHABETICAL LIST	46

## SUPPLEMENT TO PUBLICATION 181 ( 1964 )

### INDEX OF ELECTRICAL MEASURING APPARATUS USED IN CONNECTION WITH IONIZING RADIATION

#### GENERAL

##### 1. Object

The object of this Recommendation is the same as that quoted below from Clause 1 of IEC Publication 181:

The object of this Recommendation is to facilitate consideration of a certain number of electrical measuring instruments used in connection with ionizing radiation<sup>1</sup> by giving to each of them a designation and a definition permitting their unambiguous identification.

As an exception, in the field of control and safety of nuclear reactors, this Recommendation also defines certain apparatus which do not belong to the category of electrical measuring instruments in view of the necessity of considering nuclear reactor instrumentation as a whole.

##### 2. Choice of apparatus

As stated in Chapter I, Clause 2 of Publication 181, the Publication is an index of the measuring instruments, which at the time of editing were currently manufactured by industry or likely to be so in the near future. It was expressly understood that the index, recognizedly incomplete, would be added to at later dates.

The present publication is the first such supplement.

##### 3. Principles and general rules

General directives for preparation of the I. E. V. and the general rules adopted in preparing Publication 181 have been followed in editing this supplement, in so far as feasible.

Experience has, however, shown that minor modifications to the principles and rules are necessary, as indicated in the following.

##### 4. Definition of apparatus

In the case of certain special purpose apparatus, given as examples of application of a more general type of apparatus, no definition is given where the designation is considered sufficiently explicit.

In these cases, the only apparatus defined are those possessing constructional and/or operational characteristics clearly distinct from those of other apparatus. Specialized versions of general apparatus that are defined are listed without definition.

*For example:*

- Particle flux density meter
- is defined, but:
- Electron flux density meter
  - Gamma [X] flux density meter
  - Neutron flux density meter

as examples of application are merely quoted.

##### 5. Numbering

Provisions have been made and utilized in Publication 181 for the insertion of new items and sections. However, so as not to prematurely exhaust the limited numbering provisions, a special numbering system has been adopted for examples of application. This consists of using an additional figure, separated by a slash ( diagonal ) from the identification number of the general apparatus.

*Examples:* Following 210-140 — Scintillation detector

are quoted as examples of application:

- 210-140/1 Gas scintillator detector
- 210-140/2 Liquid scintillator detector
- 210-140/3 Monocrystal mineral scintillator detector
- 210-140/4 Polycrystal mineral scintillator detector
- 210-140/5 Monocrystal organic scintillator detector
- 210-140/6 Plastic scintillator detector
- 210-140/7 Well-type scintillator detector.

<sup>1</sup>As defined by the I.C.R.U.: Any radiation consisting of directly or indirectly ionizing particles or a mixture of both.

## CHAPTER I — GENERAL TERMS

### Section 1-05

#### 105-006 **Difference apparatus:**

Apparatus in which the output signal is a function of the difference between two input signals.

*Example:* Difference linear ratemeter.

**NOTE** — The term “differential” is reserved for apparatus designed to measure the elementary increments of a varying quantity.

### Section 1-10

#### 110-005 **(Radiation) Measuring assembly:**

An assembly including one or several radiation detectors and associated sub-assemblies or basic function units and designed to measure quantities concerned with ionizing radiation (activity, exposure rate, etc).

*Example:* Mean current measuring assembly for alpha particles.

(Publication 181, page 10).

*Add as synonymous the term:*

**Radiation meter.**

#### 110-105 **Measuring assembly utilizing ionizing radiation:**

An assembly including one or more radiation detectors and associated sub-assemblies or basic function units and designed to measure physical quantities by utilizing ionizing radiation. This assembly involves always a source of radiation that may or may not be included in the measuring assembly.

*Example:* Content meter (ionizing radiation).

### Section 1-15

#### 115-005 **Linear [ logarithmic ] measuring assembly:**

A measuring assembly in which the amplitude of the output signal is a linear [ logarithmic ] function of the

input signal.

#### 115-010 **Difference measuring assembly:**

A measuring assembly in which the output signal is a function of the difference between two input signals.

### Section 1-20

#### 120-005 **Cabinet:**

A bay fitted with doors.

#### 120-010 **Bay:**

A rack fitted, on one or several sides, with fixed or removable protecting (ventilating) panels.

#### 120-015 **Rack:**

A structure, generally metallic, designed to be equipped with one or more chassis.

#### 120-020 **Chassis:**

A mechanical structure, usually fitted with a front panel, and designed to support particularly electrical and/or electronic components with their connections.

#### 120-025 **Chassis for drawer sub-chassis:**

A chassis designed to receive drawer sub-chassis.

#### 120-030 **Drawer sub-chassis:**

A removable — usually sliding — structure, generally fitted with a front panel, and intended to be introduced into a chassis.

#### 120-035 **Protective cover:**

A mechanical element, completely or

partially removable, and used for protective purposes.

#### 120-040 **Panel:**

A plate, generally vertical, which constitutes a part of the external surface of an apparatus and which may be equipped with indicators, control components, connectors, etc.

#### 120-045 **Inner strip:**

A plate located behind a front pannel for the purpose of limiting access to the control components, indicators, etc, mounted on this plate.

#### 120-050 **Circuit board:**

A board supporting wired components and generally intended to be mounted inside a sub-chassis, a chassis, etc.

#### 120-055 **Control and instrument board:**

A panel or assembly of panels fitted with apparatus providing an indication of the state of a plant (or other installation) and from which the plant (or other installation is controlled).

#### 120-060 **Control and instrument desk (console):**

Control and instrument board, or a part thereof, arranged in the form of a desk for the convenience of the operator.

## CHAPTER II — BASIC RADIATION MEASURING APPARATUS

### Section 2-05 — ( Radiation ) measuring assemblies

#### 205-096 Time-of-flight neutron spectrometer:

An analyzing assembly designed to determine the energy spectrum of the neutrons in a beam, by measuring the times-of-flight over a given flight path.

#### 205-104 (Radio) activity meter:

An assembly designed to measure the activity of a radiation emitter and

equipped with an indicating and/or recording instrument.

#### 205-126 Gaseous phase radiochromatograph:

A measuring assembly designed to draw a representative curve of the activity of different labelled components of gaseous phase mixture flowing past a radiation detector after having been separated along a chromatographic column.

### Section 2-10 — Radiation detectors

#### 210-106 Spark chamber:

A track chamber in which the paths of ionizing particles are indicated by a succession of sparks.

#### 210-140 Scintillation detector:

A radiation detector using a medium in which a burst of luminescence radiation is produced along the path of an ionizing particle.

It consists of a scintillator, usually associated with a photomultiplier tube.

(Publication 181, page 14).

*Examples of application to be added:*

##### 210-140/1 Gas scintillator detector.

##### 210-140/2 Liquid scintillator detector.

##### 210-140/3 Monocrystal mineral scintillator detector.

##### 210-140/4 Polycrystal mineral scintillator detector.

##### 210-140/5 Monocrystal organic scintillator detector.

##### 210-140/6 Plastic scintillator detector.

##### 210-140/7 Well-type scintillator detector.

#### 210-146 Diffused junction semiconductor detector:

A semiconductor detector in which the P-N or N-P junction is produced by diffusion of donor or acceptor impurities.

**NOTE** — The first letter designates the type of the diffused impurities.

#### 210-147 Surface barrier semiconductor detector:

A semiconductor detector utilizing a junction due to a surface inversion layer.

#### 210-148 P.I.N. semiconductor detector:

##### Compensated semiconductor detector:

A semiconductor detector consisting of a compensated region between P and an N region. The compensated region is frequently referred to as "intrinsic".

#### 210-151 Self-quenched counter tube:

A radiation counter tube in which the quenching is effected by a suitable gas mixture in the absence of any other device.

*Examples of application:*

##### 210-151/1 Halogen counter tube.

##### 210-151/2 Organic vapour counter tube.

### Section 2-15 — Sub-assemblies

#### 215-005 Amplitude analyzer:

A sub-assembly for determining the distribution function of a set of pulses in terms of their amplitude.

(Publication 181, page 16),

*Example of application:*

##### 215-005/1 Single channel amplitude analyzer.

#### 215-016 Analog-to-digital converter:

A sub-assembly designed to provide an output signal which is a digital representation of the analog input signal.

#### 215-017 Pulse amplitude-to-time converter:

An electronic sub-assembly, designed

to provide, according to the type of apparatus:

- a) An output pulse the duration of which is proportional to the amplitude of the input pulse;
- or b) Two output pulses, one delayed with respect to the other by a time interval that is proportional to the amplitude of the input pulse.

**215-018 Time-amplitude converter:**

An electronic sub-assembly designed to provide a voltage pulse with an amplitude proportional to the time interval between two signals.

**215-019 Digital-time-converter:**

A sub-assembly designed to provide an output signal which is the digital representation of the time interval between two input signals.

**215-021 Difference scaler:**

A scaler having two inputs, which adds one to its contents for each pulse arriving at one input and subtracts

one from its contents for each pulse arriving at the other input.

**215-022 Reversible scaler:**

A scaler with a single output, which for each incoming signal pulse adds one to its contents or subtracts one from its contents, according to an auxiliary control.

**215-035 Linear ratemeter:**

An electronic sub-assembly which gives a continuous indication proportional to the average counting rate over a predetermined time interval.

( Publication 181, page I6 ).

*Example of application to be added:*

**215-035/1 Difference linear ratemeter.**

**215-045 Spectrum stabilizer:**

A sub-assembly designed to be associated with a radiation spectrometer for compensating the drift of the detectors and the electronic circuit in order to stabilize the abscissa of a defined peak.

**Section 2-20 — Basic function units**

**220-006 Biassed linear amplifier:**

A pulse amplifier which, within the limits of its normal operating characteristics, has constant gain for that portion of an input pulse that exceeds the threshold value and that produces no output for pulses whose amplitude is below the threshold.

**220-007 Charge pulse amplifier:**

An amplifier designed to provide an output pulse whose amplitude is proportional to the input pulse charge.

**220-061 Pulse shape discriminator unit:**

A basic function unit containing a pulse shape discriminator.

*Pulse shape discriminator unit:*

A circuit designed to produce different output signals for different shapes of the input pulses in order to distinguish between pulses of different origin.

**220-081 Delayed coincidence unit:**

A coincidence selector unit designed

to produce an output signal when one or more pulses are delayed by a specified time interval with respect to another.

**220-089 Power supply unit:**

Basic function unit designed to supply electrical power to an assembly or sub-assembly.

**220-095 Floating power supply:**

A power supply electrically isolated from any common circuits.

**220-100 D. C. amplitude discriminator unit:**

A basic function unit which gives an output signal when the d.c. input voltage or current exceeds a given threshold value.

**220-105 Charge discriminator unit:**

A basic function unit which gives an output signal when the electrical charge exceeds a given threshold value.

## CHAPTER III — SPECIAL APPARATUS FOR THE CONTROL AND THE SAFETY OF NUCLEAR REACTORS

### Section 3-05 — Nuclear measuring apparatus ( of a nuclear reactor )

#### **305-005 Power measuring assembly based on the neutron flux density:**

A measuring assembly designed to determine the thermal power of a nuclear reactor by measuring the neutron flux density at a specified point or points.

(Publication 181, page 18.)

*Examples of application to be added:*

#### **305-005/1 Linear power measuring assembly based on the neutron flux density. ( of a nuclear reactor ).**

#### **305-005/2 Logarithmic power measuring assembly based on the neutron flux density. ( of a nuclear reactor ).**

#### **305-010 Power measuring assembly based on gamma radiation:**

A measuring assembly designed to determine the thermal power of a nuclear reactor by measuring the gamma flux density at a specified point or points.

(Publication 181, page 18.)

*Examples of application to be added:*

#### **305-010/1 Linear power measuring assembly based on gamma radiation (of a nuclear reactor).**

#### **305-010/2 Logarithmic power measuring assembly based on gamma radiation (of a nuclear reactor).**

### Section 3-10 — Warning or safety mechanisms and assemblies ( of a nuclear reactor )

#### **310-030 Safety mechanism ( of a nuclear reactor ):**

A mechanism designed to initiate or accomplish the rapid decrease in reactivity, for example by movement of safety elements.

(Publication 181, page 19).

*Examples of application to be added:*

#### **310-030/1 Fluid poison injection safety mechanism ( of a nuclear reactor ).**

#### **310-030/2 Moderator dumping safety mechanism ( of a nuclear reactor ).**

### Section 3-20 — Various measuring assemblies ( for a nuclear reactor )

#### **320-021 Coolant leakage measuring assembly ( of a nuclear reactor ):**

A measuring assembly designed to determine the loss of coolant from a nuclear reactor.

#### **320-046 Coolant gross activity monitor (of a nuclear reactor):**

A monitor designed to measure the activity of the coolant of a nuclear reactor and to give a warning when it exceeds a predetermined value.

#### **320-054 Fission products poisoning predictor (for a nuclear reactor):**

A computer designed to determine the evolution, due to the fission products poisoning, of the reactivity of a nuclear reactor.

*Examples of application:*

#### **320-055 Xenon poisoning predictor (for a nuclear reactor).**

#### **320-058 Coolant leakage indicator (of a nuclear reactor):**

An indicator designed to detect the

loss of coolant of a nuclear reactor.

*Example of application:*

#### **320-058/1 Coolant circuit leakage indicator (of a nuclear reactor).**

#### **320-060 Temperature meter (for a nuclear reactor):**

An assembly for measuring the temperature at a point in a nuclear reactor.  
(Publication 181, page 21.)

*Examples of application to be added:*

#### **320-060/1 Fuel cladding temperature meter (of a nuclear reactor).**

#### **320-060/2 Channel outlet coolant temperature meter (of a nuclear reactor).**

#### **320-070 Heavy water content meter (for nuclear reactor):**

A content meter designed for continuously or discontinuously determining the heavy water content of a heavy water — light water mixture in a nuclear reactor.

## CHAPTER IV — SPECIAL APPARATUS FOR HEALTH PHYSICS

### Section 4-05 — Exposure or absorbed dose, exposure or absorbed dose rate or flux density meters

#### 405-016 Particle flux density meter:

A measuring assembly for particle flux density.

*Examples of application:*

##### 405-016/1 Electron flux density meter.

##### 405-016/2 Gamma [X] flux density meter.

##### 405-016/3 Neutron flux density meter.

#### 405-041 Charger-reader:

Apparatus for charging a capacitor type dosimeter and for measuring the charge thereon.

#### 405-043 Radiation exposure indicator:

An indicator designed to detect the presence of gamma [X] radiation and to give an estimate of the exposure.

#### 405-050 Dosimeter:

An assembly designed to measure radiation so as to permit evaluation of absorbed dose.

*Examples of application:*

##### 405-050/1 Ionization chamber dosimeter.

##### 405-050/2 Tissue-equivalent ionization chamber dosimeter ( gamma [X] rays).

##### 405-050/3 Semiconductor detector dosimeter.

#### 405-070 Dose ratemeter:

An assembly designed to measure radiation so as to permit evaluation of absorbed dose rate.

*Example of application:*

##### 405-070/1 Tissue-equivalent ionization chamber dose ratemeter (gamma [X] rays).

#### 405-080 Particle flux density monitor:

A monitor designed to measure and respond to particle flux density.

*Examples of application:*

##### 405-080/1 Electron flux density monitor.

##### 405-080/2 Gamma [X] flux density monitor.

##### 405-080/3 Neutron flux density monitor.

#### 405-100 Particle flux density indicator:

An indicator designed to give an estimate of particle flux density.

*Examples of application:*

##### 405-100/1 Electron flux density indicator.

##### 405-100/2 Gamma [X] flux density indicator.

##### 405-100/3 Neutron flux density indicator.

### Section 4-10 — Contamination or activity measuring assemblies

#### 410-001 Surface contamination meter:

A measuring assembly for determining the activity per unit surface, associated with the contamination of an object.

*Examples of application:*

##### 410-001/1 Tritium surface contamination meter.

##### 410-001/2 Floor contamination meter.

#### 410-002 Surface contamination monitor:

A monitor designed to measure the activity per unit surface associated with the contamination of the examined object and to give a warning when it exceeds a predetermined value.

*Examples of application:*

##### 410-002/1 Laundry contamination monitor.

##### 410-002/2 Floor contamination monitor.

#### 410-003 Surface contamination indicator:

An indicator designed to give an estimate of the activity per unit surface associated with the contamination of the examined object.

*Example of application:*

##### 410-003/1 Floor contamination indicator.

#### 410-011 Beta-gamma door-way monitor:

A monitor with detectors arranged about a doorway to give a measure of beta and/or gamma contamination carried by persons or things passing through the door-way and to give a warning when it exceeds a predetermined value.

**410-027 Air contamination meter:**

An assembly for measuring the activity of aerosols, vapours or gas per unit volume of air.

**410-028 Air contamination monitor:**

A monitor designed to measure the activity of aerosols, vapours or gas per unit volume of air and to give a warning when it exceeds a predetermined value.

*Examples of application:*

**410-028/1 Iodine air monitor with continuous sampling.**

**410-028/2 Iodine air monitor with discontinuous sampling.**

**410-028/3 Tritium air monitor.**

**410-028/4  $^{14}\text{C}$  air monitor.**

**410-029 Air contamination indicator:**

An indicator designed to detect the presence of contamination by vapours, aerosols or gas in air.

**410-046 Evaporated sample liquid activity meter:**

An assembly designed to measure the specific activity of a liquid and utilizing for this purpose residues of evaporated samples.

**Section 4-20 — Criticality protection assemblies**

**420-005 Criticality monitor:**

A monitor designed to measure a quantity connected with a possible criticality accident and to give a warning when it exceeds a predetermined value.

*Examples of application:*

**420-005/1 Criticality monitor based on gamma radiation.**

**420-005/2 Criticality monitor based on neutron radiation.**



**CHAPTER VI — APPARATUS USING, FOR THE MEASUREMENT, AN IONIZING RADIATION SOURCE**

**Section 6-25 — Various measuring assemblies ( ionizing radiation )**

**625-015 Radiation proximity indicator:**

An indicator including an ionizing radiation source and a radiation detector, designed to give an estimate of the relative proximity of two objects,

by using the direct or scattered radiation.

*Example of application:*

**625-015/1 Direct radiation proximity indicator.**

## ALPHABETICAL LIST

## A

Activity meter ( Radio )	...	...	205-104
Air contamination indicator	...	...	410-029
Air contamination meter	...	...	410-027
Air contamination monitor	...	...	410-028
Amplitude analyzer	...	...	215-005
Analog-to-digital converter	...	...	215-016

## B

Bay	...	...	120-010
Beta-gamma door-way monitor	...	...	410-011
Biassed linear amplifier	...	...	220-006

## C

Cabinet	...	...	120-005
<sup>14</sup> C air monitor	...	...	410-028/4
Channel outlet coolant temperature meter ( of a nuclear reactor )	...	...	320-060/2
Charge discriminator unit	...	...	220-105
Charge pulse amplifier	...	...	220-007
Charger-reader	...	...	405-041
Chassis	...	...	120-020
Chassis for drawer sub-chassis	...	...	120-025
Circuit board	...	...	120-050
Compensated semiconductor detector	...	...	210-148
Control and instrument board	...	...	120-055
Control and instrument desk ( console )	...	...	120-060
Coolant circuit leakage indicator ( of a nuclear reactor )	...	...	320-058/1
Coolant gross activity monitor ( of a nuclear reactor )	...	...	320-046
Coolant leakage indicator ( of a nuclear reactor )	...	...	320-058
Coolant leakage measuring assembly ( of a nuclear reactor )	...	...	320-021
Criticality monitor	...	...	420-005
Criticality monitor based on gamma radiation	...	...	420-005/1
Criticality monitor based on neutron radiation	...	...	420-005/2

## D

Delayed coincidence unit	...	...	220-081
Difference apparatus	...	...	105-006
Difference linear ratemeter	...	...	215-035/1
Difference measuring assembly	...	...	115-010
Difference scaler	...	...	215-021
Diffused junction semiconductor detector	...	...	210-146
Digital time-converter	...	...	215-019
D. C. amplitude discriminator unit	...	...	220-100
Direct radiation proximity indicator	...	...	625-015/1
Dosemeter	...	...	405-050
Dose ratemeter	...	...	405-070
Drawer sub-chassis	...	...	120-030

## E

Electron flux density indicator	...	...	405-100/1
Electron flux density meter	...	...	405-016/1
Electron flux density monitor	...	...	405-080/1
Evaporated sample liquid activity meter	...	...	410-046

## F

Fission products poisoning predictor ( for a nuclear reactor )	...	...	320-054
Floating power supply	...	...	220-095
Floor contamination indicator	...	...	410-003/1
Floor contamination meter	...	...	410-001/2
Floor contamination monitor	...	...	410-002/2
Fluid poison injection safety mechanism ( of a nuclear reactor )	...	...	310-030/1
Fuel cladding temperature meter ( of a nuclear reactor )	...	...	320-060/1

## G

Gamma [X] flux density indicator	...	...	405-100/2
Gamma [X] flux density meter	...	...	405-016/2
Gamma [X] flux density monitor	...	...	405-080/2
Gas scintillator detector	...	...	210-140/1
Gaseous phase radiochromatograph	...	...	205-126

## H

Halogen counter tube	...	...	210-151/1
Heavy water content meter ( for a nuclear reactor )	...	...	320-070

## I

Inner strip	...	...	120-045
Iodine air monitor with continuous sampling	...	...	410-028/1
Iodine air monitor with discontinuous sampling	...	...	410-028/2
Ionization chamber dosimeter	...	...	405-050/1

## L

Laundry contamination monitor	...	...	410-002/1
Linear (logarithmic) measuring assembly	...	...	115-005
Linear power measuring assembly based on gamma radiation ( of a nuclear reactor )	...	...	305-010/1
Linear power measuring assembly based on the neutron flux density ( of a nuclear reactor )	...	...	305-005/1
Linear ratemeter	...	...	215-035
Liquid scintillator detector	...	...	210-140/2
Logarithmic power measuring assembly based on gamma-radiation ( of a nuclear reactor )	...	...	305-010/2
Logarithmic power measuring assembly based on the neutron flux density ( of a nuclear reactor )	...	...	305-005/2

## M

Measuring assembly utilizing ionizing radiation	...	...	110-105
Measuring assembly ( radiation )	...	...	110-005
Moderator dumping safety mechanism ( of a nuclear reactor )	...	...	310-030/5
Monocrystal mineral scintillator detector	...	...	210-140/3
Monocrystal organic scintillator detector	...	...	210-140/2

## N

Neutron flux density indicator	...	...	405-100/3
Neutron flux density meter	...	...	405-016/3
Neutron flux density monitor	...	...	405-080/3

## O

Organic vapour counter tube	...	...	210-151/2
-----------------------------	-----	-----	-----------

## P

Panel	...	...	120-040
Particle flux density indicator	...	...	405-100
Particle flux density meter	...	...	405-016
Particle flux density monitor	...	...	405-080
P. I. N. semiconductor detector	...	...	210-148
Plastic scintillator detector	...	...	210-140/6
Polycrystal mineral scintillator detector	...	...	210-140/4
Power measuring assembly based on the gamma radiation	...	...	305-010
Power measuring assembly based on the neutron flux density	...	...	305-005
Power supply unit	...	...	220-089
Protective cover	...	...	120-035
Pulse amplitude-to-time converter	...	...	215-017
Pulse shape discriminator unit	...	...	220-061

## R

Rack	...	...	120-015
Radiation exposure indicator	...	...	405-043
( Radiation ) measuring assembly	...	...	110-005

Radiation meter	...	...	110-005
Radiation proximity indicator	...	...	625-015
( Radio ) activity meter	...	...	205-104
Reversible scaler	...	...	215-022

**S**

Safety mechanism ( of a nuclear reactor )	...	...	310-030
Scintillation detector ..	...	...	210-140
Self-quenched counter tube	...	...	210-151
Semiconductor detector dosimeter	...	...	405-050/3
Single channel amplitude analyzer	...	...	215-005/1
Spark chamber	...	...	210-106
Spectrum stabilizer	...	...	215-045
Surface barrier semiconductor detector	...	...	210-147
Surface contamination indicator	...	...	410-003
Surface contamination meter	...	...	410-001
Surface contamination monitor	...	...	410-002

**T**

Temperature meter ( for a nuclear reactor )	...	...	320-060
Time amplitude converter	...	...	215-018
Time-of-flight neutron spectrometer	...	...	205-096
Tissue-equivalent ionization chamber dose-	...	...	...
meter ( gamma [X] rays )	...	...	405-050/2
Tissue-equivalent ionization chamber dose	...	...	...
ratemeter ( gamma [X] rays )	...	...	405-070/1
Tirtium air monitor	...	...	410-028/3
Tirtium surface contamination meter	...	...	410-001/1

**W**

Well-type scintillator detector	...	...	210-140/7
---------------------------------	-----	-----	-----------

**X**

Xenon poisoning predictor ( for a nuclear	...	...	...
reactor )	...	...	320-055

# BUREAU OF INDIAN STANDARDS

## Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, NEW DELHI 110002

Telephones: 3310131, 3311375

Telegrams: Manaksanstha  
(Common to all offices)

## Regional Offices:

Telephone

Central: Manak Bhavan, 9 Bahadur Shah Zafar Marg,  
NEW DELHI 110002

3310131, 3311375

\*Eastern: 1/14 C.I.T. Scheme VII M, V.I.P. Road, Maniktola,  
CALCUTTA 700054

362499

Northern: SCO 445-446, Sector 35-C, CHANDIGARH 160036

21843, 31641

Southern: C.I.T. Campus, MADRAS 600113

412442, 412519, 412916

†Western: Manakalaya, E9 MIDC, Marol, Andheri ( East )  
BOMBAY 400093

6329295

## Branch Offices:

'Pushpak' Nurmohamed Sheikh Marg, Khanpur, AHMADABAD 380001

26348, 26349

Peenya Industrial Area, 1st Stage, Bangalore-Tumkur Road,  
BANGALORE 560058

384955, 384956

Gangotri Complex, 5th Floor, Bhadbhada Road, T.T. Nagar,  
BHOPAL 462003

66716

Plot No. 82/83, Lewis Road, BHUBANESHWAR 751002

53627

53/5 Ward No. 29, R.G. Barua Road, 5th By-lane, GUWAHATI 781003

5-8-56C L. N. Gupta Marg ( Nampally Station Road ),  
HYDERABAD 500001

231083

R14 Yudhister Marg, C Scheme, JAIPUR 302005

63471, 69832

117/418 B Sarvodaya Nagar, KANPUR 208005

216876, 218292

Patliputra Industrial Estate, PATNA 800013

62305

T.C. No. 14/1421, University P.O., Palayam, TRIVANDRUM 695035

62104, 62117

## Inspection Offices ( With Sale Point ):

Pushpanjali, First Floor, 205A West High Court Road, Shankar Nagar  
Square, NAGPUR 440010

25171

Institution of Engineers ( India ) Building, 1332 Shivaji Nagar,  
Pune 411005

52435

\*Sales Office in Calcutta is at 5 Chowringhee Approach, P. O. Princep Street,  
Calcutta 700072

276803

†Sales Office in Bombay is at Novelty Chambers, Grant Road, Bombay 400097

896528